

# SOUTHERN TIBET

BY SVEN HEDIN



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SVEN HEDIN

# SOUTHERN TIBET

1906—1908



# SOUTHERN TIBET

DISCOVERIES IN FORMER TIMES COMPARED  
WITH MY OWN RESEARCHES IN 1906—1908

BY

SVEN HEDIN

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VOL. IV

KARA-KORUM AND CHANG-TANG



915.15

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## E R R A T A

Page	5, line 16	from the bottom, stands	<i>T'ankse</i>	for	<i>Muglib</i>
"	14, " 20	" " top,	" <i>August 28th</i>	"	<i>August 29th</i>
"	56, on the photo		" RO	"	TO
"	149, line 2 and 10	" " bottom,	" 4,893	"	4,993
"	194, " 10	" " "	" <i>CCLXI</i>	"	<i>CCLIX</i>
"	196, " 7	" " "	" 4,199	"	4,190
"	196, " 7	" " "	" 1,231	"	4,000
"	202, " 18	" " "	" 3,990	"	3,985
"	210, " 2	" " "	" 11 km.	"	11.4 km.
"	303, " 10	" " "	" 4,634	"	4,654
"	317, " 6	" " top,	" 4,920	"	4,882
"	319, " 2	" " "	" 4,089; 88	"	4,069; 108
"	319, " 3	" " "	" 148	"	120
"	319, " 8	" " bottom,	" 123	"	169
"	319, " 9	" " "	" 73	"	53
"	336, " 11	" " "	" 2nd	"	1st
"	344, " 14	" " "	" <i>CXLII</i>	"	<i>CXLII</i>
"	345, " 12	" " "	" Kyam	"	Kyang
"	360, " 16	" " top,	" rise	"	fall
"	361, " 3	" " "	" km.	"	m.
"	383, " 14	" " bottom,	" 281; 40	"	134; 84
"	383, " 16	" " "	" 199; 74	"	396; 37
"	383, " 17	" " "	" 4,979	"	4,782
"	384, " 1	" " top,	" 4,979	"	4,782

JOURNEY ACROSS TIBET  
1906—1907



## CHAPTER I.

### THROUGH THE KARA-KORUM VALLEYS.

In Vol. II, I have described my journeys around and across the *Manasarovar* and *Rakas-tal* Lakes and those to the sources of the three famous rivers, the *Brahmaputra*, the *Satlej* and the *Indus*, as well as my journey in the valley of the upper course of the first-mentioned, the *Tsangpo*. In Vol. III, I have given a description of my eight crossings of the Transhimalayan mountain system and of my researches in the region of the Central Lakes, situated just north of the *Transhimalaya*. It now remains to give a short narrative of the observations undertaken during my two crossings of Northern and Central Tibet, the first in 1906 and the second in 1908. Having thus finished the description of the whole journey from the point of view of physical geography, I will try to give a résumé of the orographical, morphological, hypsometrical and hydrographical observations as compared with my earlier results and those of other travellers. These conclusions will be found at the end of Vol. VII which deals chiefly with the discoveries in the *Kara-korum* Mountains. This gigantic system which from a point of view of genetic orography may be called the backbone of High Asia, is to a very great extent touched by the two crossings described in Vol. IV. In the résumé at the end of Vol. VII, I will attempt to analyze, if and how far the orographical boundaries of the *Kara-korum* System may be fixed with the assistance of the store of knowledge we possess at the present day.

The practical arrangements of this journey, as, for instance, the number of servants and animals in my caravan, the equipment, the instruments, etc. having been dealt with in my personal narrative, I leave them alone in this connection, and only direct my attention to the journey itself and to the geography of the traversed country. The first days' marches I have described elsewhere. Be it sufficient here to say that we left *Leh* on *August 14th, 1906*, and travelled *via Tikse, Chimre, Singrul, Sultak*, and *Drugub* to *Tankse*, a village which I reached on *August 19th*, and which is the first place entered on my map in 1:300 000, Pl. 1. Here, according

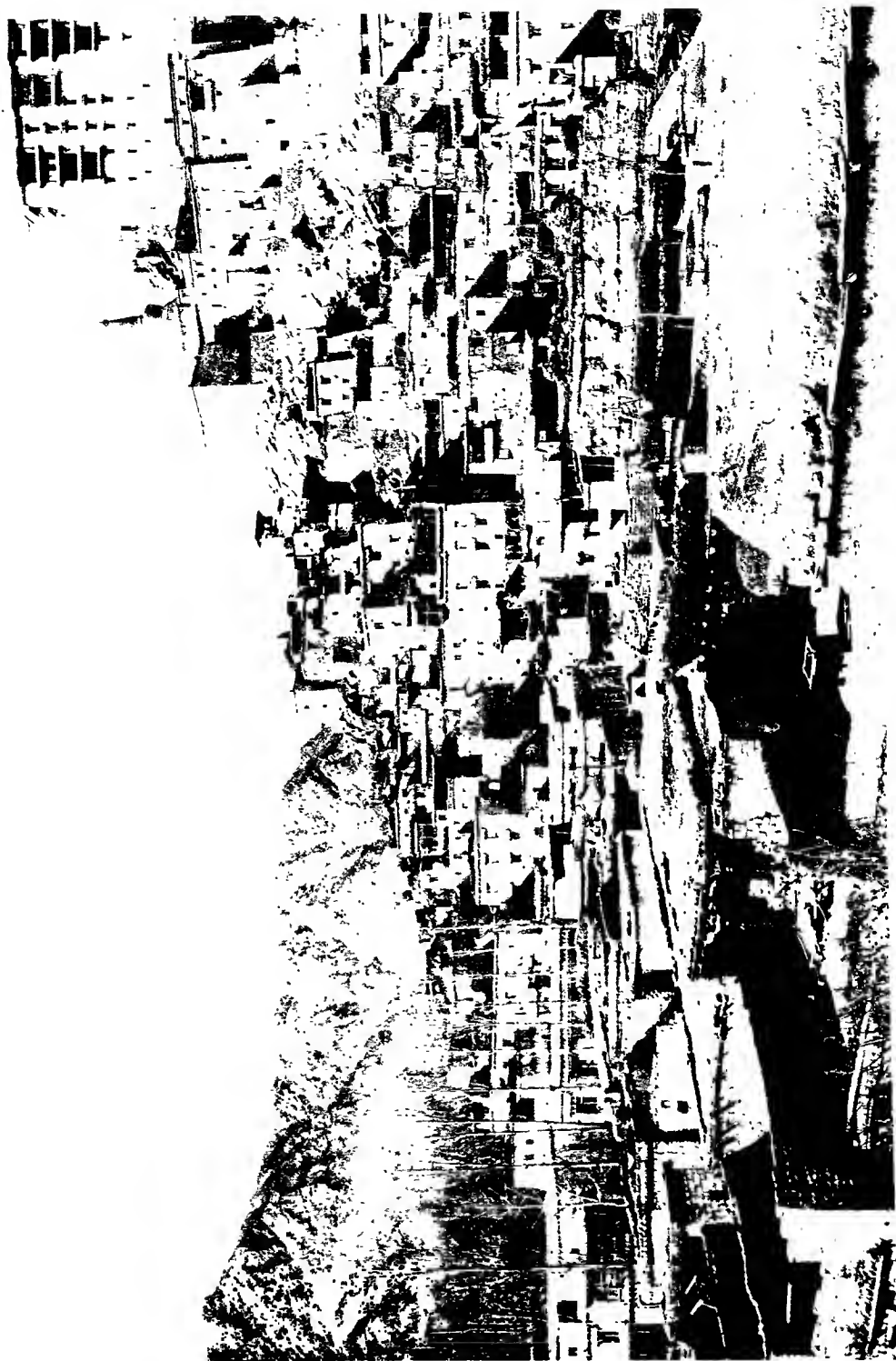
to my several observations on earlier and later occasions, the absolute height is 3,991 m., and from this considerable altitude one reaches still higher and higher regions in the course of the following days, until one, at my *Camp I*, finds oneself on the surface of the tremendous highland, which with a very proper general term may be called *Chang-tang*, or The Northern Plain, a signification which otherwise only belongs to those parts of the plateau-land which are inhabited by Tibetan nomads.

At *Tankse* two valleys join. The one coming from the south, which I came down in 1901, carries the greater amount of the water forming the rivulet of *Drugub*. The other, coming from the east, had a little brook with only 1 cub. m. of water per second. Through this valley our march continues to the S. E., E., N. E. and again S. E. to *Muglib*. The distance is 15 km., and as *Muglib* is at 4,140 m., this means a rise of 149 m., or 1:100. The rocks on the sides of the valley consist of leptite, gneiss and gneiss-granite. At the entrance of the valley there is a little *gompa* to the left and a ruin to the right. Two or three small gardens are seen, after which there are no more trees until *Muglib*. But there is still space enough for small meadows with good grazing. Two erosion terraces show that the brook has carried a considerable amount of water in post-glacial time. The road is situated between the two, and, therefore, a few meters above the brook. From the left side, or S. E., a large tributary valley opens. On the upper part of the crest there was still some snow left. Beyond this place the valley, turning N. E., is a little broader, and there is more room for meadows, the slope is gentle, and the brook does not form any rapids as hitherto. It looks like a narrow channel winding in all directions, and is well cut down in the soft grass-covered ground. Sometimes great granite blocks are passed. Between the projecting mountain-shoulders the screes of detritus slope down, forcing the brook to its meandering course, but always leaving a narrow part of the bottom of the valley.

At the place where the valley makes its sharp bend from N. E. to S. E., some small transverse valleys come in from the north, and here three small *mani rigmos* have been constructed. As a rule the brook keeps closer to the left side of the valley, and the road follows the right one, not crossing the river a single time. Beyond a gigantic scree from the right side, the meadows of *Muglib* are seen with their excellent grass. Here is the little village of the same name consisting of two or three huts, around which some barley and peas are grown. The latter seldom get ripe.

As *Muglib* is the first place where I drew a panorama of the landscape surrounding the camp, I think it suitable to say a few words of this way of illustrating the journey. By a comparison of the present work with my *Scientific Results of a Journey in Central Asia, 1899—1902*, it will at first sight seem as if the latter were much richer in pencil drawn sketches than the present one. This is, however, not





A PART OF LEH, CAPITAL OF LADAK





THE PRINCIPAL STREET OF LEH.



ABANDONED HOUSE AT LUNKAR.



the case. On the contrary, the present narrative has been illustrated in a richer and more systematic way than the former. But the illustrations have to be looked for in the accompanying Atlas of Tibetan panoramas. In the following description I will direct the attention to them, as they give a much clearer idea of the habitus and morphology of the country than any maps or any verbal descriptions could do. The text in the following chapters will be much better understood if the corresponding panoramas are studied simultaneously. Text and illustrations have to follow each other. The panoramas are as a rule drawn from the camps and from commanding passes. At every place where a panorama has been drawn, a red P is entered on the map. There are, of course, many camps and many passes where no panoramas have been drawn. This depends upon the weather or other special reasons. As to the Transhimalayan panoramas, I will describe them at the end of this volume.

Now, returning to *Muglib*, we find the panorama taken from that place as 2A and 2B on Tab. 1 of the Atlas. It embraces the whole horizon. Nobody would believe that it was taken from the bottom of a comparatively narrow erosion valley. But comparing it with the map of the region around *Muglib* on Pl. 1, you will easily recognize all the topographical details. One has only to remember the laws of perspective. To the N.  $58^{\circ}$  W. we look down the valley and to the S.  $55^{\circ}$  E. we look up the valley. These are the two extreme ends of the view. The mountain-shoulders situated to the N.  $43^{\circ}$  E. and S.  $20^{\circ}$  W. look comparatively large, which is caused by their being close to the camp. From the N. W. to the N. E. the upper erosion terrace is clearly seen. One also gets the impression that the valley becomes more accentuated and more deep-cut in the direction of *Ladak* than in the direction of Tibet.

From *Tankse* the road continues S. E. and E. S. E. to *Panggong-tso* and thence northwards to *Pobrang*. The distance is 32 km., and the absolute height at *Pobrang* is 4,468 m., meaning a rise of 328 m., or, disregarding the fact that two different valleys are included, 1:97. The road passes the little hamlet of *Muglib*, a small bridge, and a round *manî*, and several times crosses the brook, which is meandering in all directions over swampy grass-covered ground. Sometimes the ground is stony. The brook has now about the same volume of water day and night, as it comes from the little lake in the valley. At its northern shore hard rock is cropping up, consisting of leptite. A little higher up in the valley is a second minimal lake or pool. The road follows its southern shore and the edge of a scree at the foot of which some crystal clear springs come out. About half of the amount of water in the brook comes from them. The valley then becomes more narrow between light yellowish-red rocks with steep sides. The bottom of the valley is sandy, and at the left side there are some small sand dunes. At the same side many small springs come out from below the detritus at the mountain foot, and then there is very little left of the brook. This flows down from a tributary gorge to the south, in the

background of which a snow-covered ridge is to be seen. The rock is limestone, marble and leptite, and is coloured white, yellow and black.

The bottom of the valley being nearly flat to the eye, it is difficult to say where the water-parting threshold between *Panggong-tso* and the *Indus* is situated. It seems, however, to be at the place where a *mani* and a cairn with rags are built. Here I got the height of 4,329 m. East of this place the ground falls decidedly in the direction of the *Panggong-tso*, but only for a short distance, for then again the ground seems to be nearly flat. The road follows an old river-bed between erosion terraces, through which at an earlier epoch the *Panggong-tso* drained to the *Indus*. At the point where the *Pobrang* brook emptied some 2 or 3 cub. m. of water per second into the lake, and where the height is 4,317 m., we turn northwards along the brook. The right erosion terrace was 51 cm. high and ran out like a cape in the lake. The view of the bluish green lake stretching S. E. between gigantic mountains, is magnificent. Here I left the road I had followed nearly 5 years earlier, on December 15, 1901.

The road sticks to the top of the right erosion terrace. The ground is sandy with a few rudimentary dunes and with sparse tussocks. At my first visit the bed was filled with drifting sand which now had disappeared. The accumulation of sand takes place during the dry season, and is swept away as soon as the water again comes down from the melting snows in the spring or early summer. The erosion terrace grows higher; it is soon 2 m., later on 4 or 6 m. high, especially where a scree from the right side of the valley is cut through by the water; here the left terrace is very low or missing altogether, and the bed of the brook is divided into several branches.

*Lukkung* is the name of a hamlet consisting of two or three stone huts, a *chorten*, a barley field and a tree. Having turned in a more north-easterly direction, a considerable valley opens up in front of us bounded in the west by a mighty mountain ridge. The bottom of this valley is covered with stones and blocks. Diagonally crossing a little ridge of hills, the highest point of which is marked with two small *manis*, we came down into the *Pobrang* valley with the little village of the same name, the last in this direction.

A panorama taken from *Pobrang* (3, Tab. 1) only embraces a little more than a quadrant, or from S. 4° E. to N. 85° W., showing part of the mighty mountains south of western *Panggong-tso* and the range to the S. W. and west of *Pobrang*.

From *Pobrang* the road goes to the N. E. and east up the *Pobrang* valley to *Lunkar*. The distance is 15 km. The height of *Lunkar* being 5,151 m., the rise is 683 m. or 1:22 showing a considerable increase of the absolute altitude. Leaving two tributary valleys coming from the north called *Geb-mur* and *Ldata*, we continue, on August 24th, along the northern shore of the *Pobrang* brook, which



THE VALLEY OF LUNKAR WITH THE ROAD UP TO MARSIMIK-LA.







LUNKAR.



flows over the grass-covered ground of the valley between low hills of rounded gravel and boulders, partly also filling the bottom of the valley. Hard rock is rarely seen and difficult to reach, but the detritus seems to consist chiefly of granite. A part of the brook comes from a northern tributary valley. The greater part of the brook comes from the *Ldata* valley. At the junction there is a widening with some good grass. The road sticks to the slopes of the hills on the right or northern side of the little valley which comes down from *Marsimik-la* and *Lunkar*, and continues past *Pobrang*. The height is marked with two or three small cairns. To the east the landscape already seems to assume a more Tibetan character with more rounded forms, broader and more open valleys with mostly dry watercourses. Only to the E. N. E., there is a flat top with some snow, elsewhere all snow has disappeared. To the west three mountain ranges are visible parallel to each other and running, as it seems, N.-S. These ranges are ramifications at the S. W. side of the mightiest *Kara-korum* Range. The largest of them is the one situated just west of the *Lukkung* valley. Below us the *Ldata* valley with its grass and its brook is visible. To the south one has a beautiful view of the mighty mountains bordering the *Panggong* valley on the south. The snow-fields and névés in the upper regions of these mountains can now be easily seen. The road undulating up and down over the gravelly hills, is a mere path, sometimes hardly visible in the gray gravel. It is all that is left of the excellent road from *Srinagar* to *Leh* and it is soon going to disappear altogether.

The panorama from *Lunkar*, 5, Tab. 1, goes around the whole horizon which in this case is not very far away. To the N.  $62^{\circ}$  E. *Marsimik-la* is to be seen as a rather flat saddle between comparatively low mountains. To the S., S. W. and W. some mightier mountain ridges and tops are visible.

On *August 25th*, the distance of 13.8 km. to the camp at *Spanglung* was accomplished. First there is a rise of 442 m. in a distance of 5 km. to the pass of *Marsimik-la*, the altitude of which is 5,593 m., or 1:11.3, and then there is a fall of 485 m. in a distance of 8.8 km. down to *Spanglung* where the height is 5,108 m., the rate being here as 1:18. From *Lunkar* the pass seems to be very flat and easy, but still it is no trifle for a heavily loaded caravan, especially as it was partly covered with snow one foot deep.

The panorama from the pass, 6, Tab. 1, is very interesting, though the view, of course, only commands the S. W. and N. E., the two other directions being hidden by the relatively low hills on the crest of the range, between which the saddle of the pass is situated. The mountains to the S. W., which belong to the mighty range S. W. of *Panggong-tso*, are very imposing, and from this high point very easily visible with their snow-fields and deep, wild gorges. On the mountains to the east there is a good deal of snow. To the N. E. we see a little part of the upper reaches

of the *Spanglung* valley. In this direction the water goes down to the *Chang-chenmo* River, which is a tributary to the *Shayok* and the *Indus*. On the *Marsimik-la* we are, therefore, again on a very important water-parting, the water at one side flowing to the *Panggong-tso*, and at the other to the *Indian Ocean*.

The descent from the pass is disagreeable after a fresh snowfall followed by sunshine. The whole ground is like a quagmire with stones of all sizes, boulders and small blocks swimming in the mud, in which the horses are sinking deep at every step. The small watercourses from the melting snow unite in a brook which flows down to the N. E. From all other side valleys and gorges, brooks come down. To begin with, the slope is perceptible, but soon it becomes very gradual. The path turns to the N. N. E., and crosses a swamp with moss and small pools, treacherous for the ponies. There we follow the foot of the hills at the right side of the valley. Here the snow had disappeared. For considerable distances the path seems to run horizontally, or even sometimes to rise a little. It may be said to be characteristic of the passes leading to the great plateau-land that the inner or Tibetan side is comparatively gradual and flat, whereas the outer one is steep and often precipitous. This rule is developed to its highest degree on the *Zoji-la*, and will also be found on the *Chang-lung-yogma*.

The road follows on the right hand slopes some distance above the bottom of the valley. Everything is barren, and there is no vegetation except moss. The ground is covered with gravel. Suddenly the path goes steeply down to the bottom of the valley. Finally our pass valley joins a considerable, though very short, valley from the left, to which several tributary valleys join, coming down from the same range in which *Marsimik-la* is situated. Three of these trough-formed valleys contain glaciers in their upper regions, now covered with snow, but clearly showing the crevices in their frontal parts. Their snouts seem to reach some 50 or 100 m. below the height of *Marsimik-la*. A considerable amount of water goes down from the glaciers, forming a brook with which the one from the pass joins. At the junction there is a triangular open place with a little grass and moss. The direction now becomes north-north-easterly, and the road follows on the right hand slope of the joint valley some 150 m. above its bottom where the river is flowing in a deep-cut bed with sharp erosion terraces and without leaving the slightest space for even ground or meadows. The form of the valley is like a V with rather steep slopes on both sides consisting, at least on the right side, of gravel. There is no kind of vegetation or binding material, and the road is, therefore, extremely uncomfortable, even dangerous at some places. The view is open down the *Spanglung* valley to the N. E. where it turns to the north to join the *Chang-chenmo*. It is a desolate country of grey and brownish mountains all without any sign of life. Still the landscape is picturesque and wild, and one has a presentiment of approaching High



SPANGLUNG.





MY CAMP AT SPANGLUNG.





Tibet. Finally the path goes down the gravelly slope, which is crossed by several small tributary brooks, to the junction with a valley from the right, which, according to the Ladakis, is the *Spanglung* proper. Here some grass was growing and we pitched our tents.

From *Spanglung* to our camp at *Pamsal* in the *Chang-chenmo* valley, the distance amounts to 16 km. and as the height at *Pamsal* is only 4,529 m., the difference is 579 m. or a fall of 1:27.6. The road goes down the *Spanglung* valley N. E. and north. First we go down to the *Spanglung* proper, at the right bank of which there are the ruins of a little house. Then we continue on the right slope of the main valley, less steep than hitherto, and some 40 or 50 m. above the bottom of the valley. Opposite the left tributary, *Yardep*, we follow the bottom of the valley, which now becomes broader. Here is a sheepfold of stone; shepherds from *Pobrang* were said to arrive here about the end of November and to stay in the valley during the winter. In the early hours the joint brook was much smaller than the evening before and could perhaps carry 2 cub. m. per second. Most of the bottom of the valley is covered with gravel, tiring for the animals. *Gulhläs* is the name of a tributary from the left side with a second sheepfold and some pasture. It is, however, difficult to see how sheep can live in this barren region. Probably the shepherds take them up into protected side valleys where grass is more abundant.

At the place where the main valley turns N. E., and then north, two tributary valleys, viz. *Kanglung* and *Kuyung*, open from the right. Both have brooks coming from the range we passed in *Marsimik-la*, and some of whose snowy crests and peaks are seen in the background of the valleys. In these valleys grazing-grounds are said to exist. Through the *Kanglung* valley a path is said to cross the range over an ice-covered pass which can be used only on foot. *Kuyung* has also a path which goes to *Yu*, a place on the other side of the range. The brooks from these valleys increase the main brook which gradually grows bigger on its way down to *Pamsal*. The whole region is grey gravel, boulders and blocks of gneiss-granite, but living rock is, for a long while, not attainable. Sometimes small patches of grass are passed. The brook is followed on both sides by three beautifully developed erosion terraces generally some 20 m. high. Sometimes one or two of them are subdivided into several, and lower down 6 or 7 terraces could be reckoned on the right side of the valley. They are best seen at places where tributaries cut their way through them. As a rule the road sticks to the top of the lowest terrace on the left side. The terraces are very eloquent remains from the time, the pluvial epoch, when the precipitation was much richer than nowadays.

Finally we reach a place with living rock, the same gneiss-granite as the gravel. The brook everywhere forms rapids, and there are no quiet reaches between them. Erosion is busy at work in this peripheric region with effluence to the sea. Such

valleys are extremely rare in the self-contained basins of the interior of Tibet. At one place we have the brook just below our feet, at another we climb a steep slope to the top of the third terrace, and then go down to the second one. At the right side there are now five terraces, very well developed and clearly visible the whole way down. At the junction with the right tributary, *Lungnak*, the height is 4,747 m., and in the background of this valley snow-covered mountains are seen, though lower than hitherto. To the N. 5° W. the view is magnificent. Above and beyond the red mountains on the right side of the *Chang-chenmo* River a dark, nearly black, mighty range is visible dominating everything around. In spite of its apparent height, and obviously on account of its facing towards the south, it is nearly free from snow excepting a rounded peak which is partly white. This peak was said to be situated in the neighbourhood of the pass *Chang-lung-barma*, a short distance to the west of our consequent route to *Chang-lung-yogma*. Seen from this point, the chain gives the impression of being very compact and of great length. Both the last-mentioned passes are situated in that range, which is the water-parting *Kara-korum* Range. A line joining the *Kara-korum* Pass with the *Chang-lung-yogma* becomes parallel to the high *Kara-korum* Range with the most elevated K-peaks and the world of famous glaciers as well as with the *Western Himalayas*. We will later on have to return to this most interesting orographic problem, certainly one of the most gigantic on the earth's surface.

From *Lungnak* our road continues northwards on the top of the middle terrace. The terraces are a very characteristic feature of the valley. At a passage of solid rock, as usual consisting of reddish gneiss-granite, the road is on a gravel bank which divides the brook into two branches. At the other end of the passage there are a few stone huts, and the place is called *Tak-dao* (not Yak-dao as on the map). Here a large tributary valley enters from the left, coming from the S. 62° W., where, in the background, snow-covered mountains are to be seen. Those mountains also are no doubt part of the range we crossed in *Marsinik-la*. The name of this valley is *Manlung*. It had a considerable rivulet with very muddy water. The road crosses the rivulet, and then follows the left bank of the joint river, with a very mighty perpendicular erosion terrace of gravel and shingle immediately to the left. A little farther on the river is crossed and the road goes up on the top of the right terrace. Bushes and other vegetation is now to be seen, and to the west mighty snowy mountains and peaks, bounding the *Chang-chenmo* valley, appear. Crossing the last foot hills to the right we finally enter the *Chang-chenmo* valley which seems to open the landscape, and allows more distant views up and down this great tributary of the *Indus* System. Here the camp was pitched in the midst of a belt of vegetation.

From the camp at *Pamsal*, I took a panorama of photographic plates, and from the same place I sketched a panorama around the whole horizon, 7A and 7B,

Tab. 2. It shows the mountain groups, to the N. W., north, and N. E. of the camp, which, from this point, conceal the water-parting range of the *Kara-korum*. To the N.  $69^{\circ}$  E. we see the upper reaches of the *Chang-chenmo* valley and notice the more plateau-like morphology of the regions, from which the river derives its water. Upwards through this valley the road continues to the important pass *Lanek-la*, which was closed to me by the Anglo-Indian government, but had been crossed by Carey in 1886, by Bower in 1891—92, by Dutreuil de Rhins in 1892—95, by Deasy in 1896—99, and by Rawling in 1903—4. The road I was going to take to reach the high plateau-lands of northern Tibet had chiefly been surveyed by the members of the second Forsyth Mission, as described in the historical part of this work (Vol. VII).

The nearest mountains south of the *Chang-chenmo* are visible on the panorama to the S.  $77^{\circ}$  E., and to the S. S. E. is the ramification separating the *Spanglung* valley from the main valley. To the S. W. are the ridges standing between the *Manlung* and *Chang-chenmo* valleys. And to the west we see the great main valley through which the *Chang-chenmo* goes down to the junction with the *Shayok*. One thing is very conspicuous in this panorama, and that is the high development of the erosion terraces, which, especially to the S. E., south, and S. W. even hide a considerable part of the mountains. They prove how enormous the water masses must have been which, during pluvial and post-pluvial times, have rushed down the valley, and how gigantic their erosive power has been. In those days the whole valley must have been filled with water, whereas now a comparatively very small part was covered by the water, which, it is true, in the end of August, is no more in flood.

The river has also a period in the course of 24 hours. In the evening of the 26th of August it was much bigger than at midday on the 27th, and during the night it had grown to a certain limit as was shown by considerable parts of the bed being still wet the next day. Just opposite the camp the breadth was 17 m., the maximum depth 0.88 m, and the average depth 0.55 m. The average velocity of the water was 1.50 m, and the maximum 1.90. The volume of water thus amounted to 14 cub. m. per second. In June and July the river cannot be crossed at this point. According to my Ladakis its real name is *Kograng-sanspo*, whereas *Chang-chenmo* is said to be the name of the whole region, perhaps including the tributaries to the main river. The bushes around our camp are called *ombo* by the Ladakis, and *boghana* by the Turkis.

From *Pamsal* down to *Shayok* there is a road which may be used only during the winter, when the river-bed is dry. My Ladakis knew only three names on this road: *Nomachen*, *Nomachun*, and *Ororotse*, all with fuel and some grazing, but without inhabitants. From the last-named place it was said to be a »two days» journey to the junction with the *Shayok*. To the east they reckoned five days to *Lanek-la*

passing *Kyam*, *Ningri*, *Gapsang*, *Salung*, *Lung-ngun*, *Kungma*, and the pass. At all these places excepting the pass itself, there is some grazing. From the pass they reckoned seven days to *Arport-tso*. The brook coming down from *Chang-lung-barma* joins the one from *Chang-lung-yogma*, and the joint brook is a left tributary to the *Kograng-sanspo*, which, coming from high regions of the *Kara-korum* Mountains, flows from the N. W. to the S. E., and afterwards makes a very sharp bend to the south and west, continuing past *Pamsal* to *Shayok*. The brook from *Lanek-la* is a left tributary to the *Kograng-sanspo*. *Tsoksalu* is another name for the place of our camp; *Pamsal* may properly be the name of the grazing-ground near the junction of the brook from *Spanglung*.

During a day's rest at *Pamsal* the wind came from the west, but turned at 9 o'clock p. m. when it came from the east. At this place a traveller bound for Tibet sees for the last time for several months a real river, bush vegetation and enjoys warm, comparatively dense air. The desolate country of the high plateaux, and the hard, inhospitable climate is awaiting him.

From *Pamsal* to *Gogra* is a distance of 17.8 km. which was accomplished on *August 28th*. More than half of this road follows the *Chang-chenmo* River to the E. N. E. Then it crosses the pass, *Mankook-la*, 4,839 m. high, or a rise of 310 m. in a distance of 13 km., or 1:40.6. From this pass one has 4.8 km. down to the *Kograng-sanspo* (the Ladakis pronounce tsangpo like sanspo) where the altitude is 4,740 m., meaning a fall of 99 m. or 1:48.5. From the pass the direction becomes north and N. W.

From *Pamsal* the road follows the bank of the river on the lowest erosion terrace, and is very comfortable. The bottom of the *Chang-chenmo* valley has a gentle rise to the east. *Lanek-la*, being at a distance of 85 km. is 5,486 m. high, or 957 m. higher than our camp at *Pamsal*, which gives a gradual rise of 1:89. To the naked eye it seems nearly level. The whole bottom of the valley is covered with grey gravel of gneiss-granite chiefly, amongst which the river winds in some large and several small branches. The water is just as grey as the stony landscape around. The whole way the river forms rapids, and there are no quiet stretches where the river flows without noise in one bed. At the left side of the valley there are now two terraces visible, the upper about 50, the lower about 10 m. above the bottom of the valley. On the right side one discerns four terraces, the lowest and most recent one being only 2 or 3 m. high. The country is absolutely lifeless, containing no animals, neither wild nor tame and no signs of men. The road is, however, quite visible. At our place it goes, for a short distance, like a cornice, but then again sticks to the 10 m. terrace. Sometimes we have the 50 m. terrace close at our right hand; it looks very mighty, like walls of fortresses, but is at many places cut through by the brooks of tributary valleys.



THE CHIANG-CHENMO VALLEY AT PAMSAL.





CROSSING THE CHIANG-CHIENMO ON THE ROAD TO GOKRA.







THE VALLEY UP TO CHIANG-LUNG-YOGMA. LOOKING N 4° E—N 51° E FROM CAMP GOGRA.





LOOKING DOWN THE VALLEY OF KOGRANG-TSANGPO, N 87 E—S 35 E FROM CAMP GOGRA.



Opposite the *Kadsung* gorge from the right side, our road crosses the *Chang-chenmo* River which at this place was divided into four considerable branches and seemed to carry more water than the day before. Just east of the *Kadsung* valley, the road ascends the terraces in very steep and sharp zig-zags, and finally reaches the little secondary pass *Mankook-la*, 4,839 m. high. Here the living rock is a dense, greyish white limestone. Panorama 9, Tab. 2, only gives an idea of the view to the S. S. W. and S. W. from this pass. It shows the high mountain ridges at the southern side of the *Chang-chenmo* valley. Only a few minutes away, north of the pass, a rather surprising and picturesque view is opening in front of us: deep below us we see the valley of *Kograng-sanspo* proper with all the general characteristics of the *Chang-chenmo* at *Pamsal*, the same grey and comparatively broad bottom of the valley and the same river divided into arms. To the east is a world of rounded mountains of brownish and reddish colours and without snow. Our road goes down the steep slopes and then keeps on the tops of erosion terraces. Here the living rock is brownish schist containing quartz. Seeing this part of the valley is sufficient to convince one that it is the upper part of the *Chang-chenmo*. This is also the opinion of the Ladakis.

*Gogra* is the name of the place where the camp was pitched at a height of 4,740 m. It is situated at the triangular opening between the bulky, brownish red mountains, where the considerable brook from the *Chang-lung-barma* receives its tributary from *Chang-lung-yogma*. These two brooks form the *Kograng-sanspo*, alias *Chang-chenmo* River. Where they meet, there is some tolerable grazing for the animals. The panorama (8A and 8B, Tab. 2) taken from *Gogra*, gives a clearer idea both of the situation and of the morphology than any descriptions in words, and it should, as usual, be compared with the map (Pl. 1). From the camp at *Gogra* we look into the openings of three deep-cut valleys, namely up into the *Chang-lung-barma* to the N. W., up into the *Chang-lung-yogma* to the N. N. E., and down the *Kograng-sanspo* to the S. E. All these valleys are readily visible on the panorama together with the mighty mountain groups surrounding them in all directions. One gets also the impression of being still in the peripheric regions with their more energetic erosive activity, their deep-cut valleys, and their still very considerable relative altitudes. Only a few days later we should find, on the plateau-lands of northern Tibet, how everything opens up, as it were, and how the horizontal lines become paramount. To the N. 3° W. we see the mountain group which separates the two *Chang-lung* valleys, and which is the southern-most end of a very bulky ramification from the water-parting protuberance of the *Kara-korum* System. To the S. W. we get a glimpse of a deep and narrow gorge; E. S. E. is the broad valley leading to *Lanek-la*, situated between the two peaks marked N. 78° E. and S. 78° E. In the S. E. we see a little of the course of the *Kograng* River turning south and west. In the foreground to the

S.  $78^{\circ}$  E. we notice in profile a series of five well developed terraces at the foot of the mountains between the upper *Kograng* River and the valley to *Lanek-la*. It should be remembered that a complete panorama of the same kind as the one in question would be best understood, if its two ends were joined together, forming a ring in the middle of which the eye of the spectator was to be placed. The compass bearings of the panorama should make it easy to arrange the panorama in accordance with the four cardinal points.

At such a place as *Gogra* where two extremely seldom used valleys meet, one may easily be uncertain which of the two is the best, especially as the natives themselves were not at all certain. The Numberdar of *Pobrang* pretended that both valleys could be used as both had roads which crossed the great water-parting range. Judging from the amount of water, the *Chang-lung-yogma* or »Lower Northern Valley» is nearer the great range of the *Kara-korum* and drains a comparatively small area, whereas the *Chang-lung-barma*, which is indeed the upper course of the *Kograng-sanspo* alias *Chang-chenmo*, drains a considerable area, but presents a greater distance to the pass that carries its name. From one point of view the *Chang-lung-yogma* was preferable, viz. as being the shortest road for reaching the Tibetan highlands, through which the distance to my goal, the perfectly unknown regions north of the *Tsangpo*, was under all conditions very great.

On *August 28th*, we accomplished the march to a place called *Chuta* at a distance of 13 km. up in the *Chang-lung-yogma* valley. As *Chuta* has a height of 4,882 m., the rise is 142 m. only, or 1:91.5, which may be said to be a comparatively slow ascent so near the crest of the highest water-parting range on the earth's crust. Just above the camp the *Kograng-sanspo* was crossed. The river was now smaller than the day before, which was quite natural after the several tributaries we had left behind. The velocity of the stream was greater. In the very angle between the two *Chang-lung* Rivers, there was a *nishan* or cairn built up, unusually big and visible all around. It may date from the days of the Forsyth Mission, which, at least partly, seems to have taken the track up the valley of the *Chang-lung-yogma*. From here an old way was also said to have passed to *Shahidullah* and *Yarkand*.

In the same angle the living rock consisted of black schist containing quartz, which was partly in a state of very advanced decomposition and weathering.

From this place the *Chang-lung-barma* valley appeared to come from the N.  $60^{\circ}$  W., and in its background snow-covered mountains were to be seen. Between these and another group without snow, and visible to the right of the first, the road up to *Chang-lung-barma-la* was said to pass. But in this point the information given by the natives was, as I have said before, unreliable and the Numberdar of *Pobrang*, who had been there some 30 years before, admitted that he had forgotten all details.

A mountain in the main valley was called *Nomeka*. Our road up the tributary valley ascends a series of terraces very much worn and rounded by wind and weather, but still clearly visible. The mountains bordering the *Chang-lung-yogma* valley on both sides are in red colours, consisting of red sandstone. Most of their material is detritus, but living rock is cropping out at many places.

The road follows the slopes at the right side of the valley, where the heights are soft and rounded and the path comfortable and readily visible. It is no doubt an old path which is still sometimes used. A mountain shoulder forces us to ascend a little threshold, from the height of which one has a wonderful and picturesque view of the valley. The limpid brook has cut its bed down between erosion terraces which seem to be at least 50 m. high, but at the same time, the gorge is very narrow. From the left side a tributary gorge, deep and wild, comes out.

A second threshold of red sandstone has the gorge of the brook just below itself. From here the path goes suddenly and steeply down to a tributary gorge. The slope is covered with fine red dust. The last bit of this road is difficult, as it is very narrow and goes down with an extremely steep gradient to the comparatively flat top of the highest terrace. We had been some 200 or 250 m. above the brook which the whole way has cut down its course in a deep, dark and very narrow gorge.

Later on we go farther down on wild rocky cliffs to the bottom of the valley, that is to say, the top of the second terrace from below and with four other terrace steps above us. The left side of the valley has a 60 m. high terrace cut down in living rock, being the same black schist as before. On account of the living rock, the terraces of the left side have grown together and form only one. The landscape is in all directions wild and picturesque. A short distance farther on we cross the brook, which now carried about  $2\frac{1}{2}$  cub. m. of water per second. The valley is here only about 20 m. broad, bordered by mountains often nearly vertical and of a dark green colour; sometimes with stripes of yellow and red. The rock consists of grey, slightly quartzitic, sandstone.

From the left side of the valley a tributary gorge opens with a little brook containing about one fourth of the amount of the *Chang-lung-yogma* brook. At the junction there is a little triangular open space. Here the main brook is seen coming out from a dark, rocky gate with perpendicular sides. One has, therefore, to climb the slope between the two valleys, and this slope is extremely steep and very difficult for loaded animals. Every pony and mule has to be assisted by men.

As in the *Chang-chenmo* valley, here also the terraces are the most characteristic feature of the landscape. The precipitation has been so great and the action of erosion of the running water so powerful, that the decomposing powers of weathering have not been able to follow the excavating action of the water, and the result is,

as in the case of *Chang-lung-yogma*, a perpendicularly cut furrow of considerable depth. Since the precipitation during post-glacial, or post-pluvial times has gradually diminished, the morphological sculpture caused by it has still remained nearly untouched, and the erosion terraces are left as they were, sometimes perfectly flat on the top for miles. The fact that the atmospherical destruction has not yet been able to destroy these terraces, proves that the excavation by the running water has taken place in a comparatively very recent time. The same phenomenon may be studied at the shores of the self-contained salt lakes in Tibet, where the beach-lines are so well conserved since the time when the basins of the lakes were filled to a much higher surface than nowadays. The extraordinary morphology observed from the thresholds of the day's march is, therefore, like a witness or a monument of an activity which has come to an end long ago. But though the amount of water in the watercourses nowadays has diminished in such a high degree, this water, especially during the flood in June and July, is still active in the same direction. It sweeps the bottom of the erosion furrows clean from detritus, sand and gravel, and excavates the valleys, though at a much slower rate than before. Therefore, the weathering gets time to follow the procedure, and the valleys, which in post-pluvial times were cut out in a vertical sense, now assume a more open and trough-shaped form.

Beyond the difficult passage we still march for a while on the top of one of the terraces where the ground is comfortable and even, and the rise, at any rate, not greater than the fall of the brook itself. Sometimes, however, disagreeable places are passed, when the precipice is yawning just at the side of the path, and the brook is hidden in its dark furrow deep below our feet.

From this passage the path goes down to the curious region at the bottom of the main valley which is called *Chuta* and where hot springs crop out of the ground. The first one forms a solid pillar in the form of a mushroom, 3 m. high, in the centre of which the water crops out and drops down from its projecting edge, where stalactites are hanging down. Here the water had a temperature of 51° C. About a hundred meters lower down, there is a rather extensive whitish red cake with ten projecting hives or mounds, some of them no more active. From below the edge of this cake a stream of hot water wells out directly into the brook. Here the water is 42° C.; at other places in the immediate vicinity, 43°. At the edge there is another pyramid 4 m. high, consisting of concentric cupola-shaped layers which partly form a vault over a grotto, where there is a water basin in direct connection with the brook. From the direction of the pyramid the water drops down into the basin. The material around the springs is travertine. Some 10 m. above the brook, there is another grotto with pouring water also forming a basin, which was cold. At several places on the banks and even in the bottom of the brook itself, water is



bubbling forth, sometimes with the sound of boiling water. From all these springs the brook gets a considerable addition of water, though it looks but little smaller above than below the place. At more protected places in the neighbourhood fresh grass is growing.

The brook is crossed at a point where it is divided into two branches, and the path ascends the terraces of the left side of the valley, where the space is very narrow. It seems to be the fourth and highest terrace. It comes to an end where a deep-cut tributary valley enters from the left with a small limpid brook in its bottom. Here, therefore, we are forced to go down into the bottom of the main valley again, but only to again ascend the slopes on the left side. The path is difficult and the ground is covered with gravel and fine dust. For a short distance the main valley widens out to about 200 m., but soon again dwindles to a narrow corridor. Still the country seems to open up a little. A new side valley again forces us down to the bottom of the main valley. This valley comes from the right side, and the Numberdar believes, that here there is another road to *Chang-lung-barma*, though he is not certain. Finally the camp is pitched in the valley supposed to be the one from *Chang-lung-yogma*. The rocks in the neighbourhood, consisting of grey, slightly quartzitic, sandstone, are strongly folded. As the road up to the pass was unknown even to the Ladakis, I had to send scouts to reconnoitre the next day. They returned with the report that the pass could be taken by the whole caravan without great difficulty.

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## CHAPTER II.

### ACROSS THE WATER-PARTING RANGE OF THE KARA-KORUM.

So far all our camps had possessed native names. From *August 31st*, we approached regions where even the Ladakis knew no appellations. I, therefore, now began to give the camps Roman numbers. The distance to *Camp I* only amounted to 7.3 km., the last place where some scanty grass was to be found south of the pass. At *Camp I* the absolute height amounted to 5,170 m., meaning a rise of 288 m. from *Camp Chuta*, or 1:25.4, or a much greater acceleration in the ascent than on the day before. The direction is N. E., but the valley is winding, and sometimes one is riding to the north. Some snow had fallen during the night, but most of it disappeared in the course of the day.

The bottom of the valley is covered with gravel, and the living rock at the sides is the same folded sandstone as before. Terraces are standing at the sides, though much smaller than lower down. At a place where the valley becomes narrow there is a little stone wall. At the right side the living rock was now grey, fine-grained sandstone-schist, strongly folded as before. Now there is no trace of a track, and no other signs of human visits than the little stone wall, which may be a hundred years old or more. Finally we enter a very small tributary valley from the right and ascend its winding course, where now only a very little brook remained. Living rock is rare, and only to be seen at the base of the slopes where the flood water is eroding, and at some places higher up. The rest of the slopes consist of gravel, sand and dust, the results of the strong powers of weathering. In this valley we have not to ascend any fatiguing terraces, but follow its bottom the whole way up, constantly crossing the brook. The morphology has undergone a considerable change. The relative altitude of the mountains has gradually diminished, and their forms are more rounded and flat or cupola-shaped. The valleys are less energetically eroded and the terraces often interrupted or missing altogether. The little brook is all that is left of the majestic *Indus* in this direction. The Ladakis believed it would

carry water still some 18 days before it became bound by the autumn cold. Sparse tussocks called *yapkak* and also *teresken* in Turki, the *Eurotia ceratoides*, so common all over the Tibetan highlands, are still to be seen on the slopes, and sometimes there is some dung of the wild yak. None of the very small side valleys have water. The guides of the previous day take us up in a second side valley from the right, from which, however, most of the brook came down. A little higher up in this valley we found the last vegetation which consisted only of the hard *yapkak* plants. On the slopes of some of the soft hills one sees what we use to call »floating earth» or mud-flows with vertical crevices, showing that the base of the hills is undermined by running water. The picturesque landscapes have now disappeared, the morphology is uninteresting, the denudation is very advanced, everything appears on a smaller scale than before; no vertical lines are to be seen.

On *September 1st*, the *Chang-lung-yogma* Pass was crossed after a new, light snowfall during the night. From *Camp I* it is 10.8 km. to the pass where the absolute height amounts to 5,780 m. This means an ascent of 610 m., or a rise of 1:17.7. On the north side of the pass we have 7.3 km. to *Camp II*, where the height is 5,552 m., a fall of 228 m. or 1:32. From these figures it is easy to conceive how very flat the water-parting range of the *Kara-korum* is, though not quite as flat as in the part of it where the famous *Kara-korum* Pass is situated some 150 km. to the N. W. The direction of the day's march is chiefly N. E.

Above *Camp I* the terraces are only 2 or 3 meters high, and deformed by the continual falling down of débris. There is not so much gravel as before, the ground chiefly being covered by fine soft dust, partly wet from the melting of the last snow. The fine decomposed material, the result of very advanced weathering, is crossed, even in the bottom of the valley, by innumerable crevices as is usual in mud-flows. The living rock is grey fine-grained sandstone-schist. The valley is winding and narrow. On Panorama 10, Tab. 2, we get an idea of the entrance to this valley in the direction N. 63° E. from *Chuta*. Already at this camp the valley looked rather small, but now it has still diminished, and it is winding N. E., E. N. E., and again N. E. between these soft, rounded, relatively low hills with their fissures at the base often arranged in the same way as the lateral crevasses of a glacier snout. One gets the impression that these hills, on account of their own weight, are floating and sliding downwards, according to the laws of gravity. There is no vegetation, except very seldom some *yapkak* plants or some moss, the roots of which could bind the loose, wet earth.

The men of my caravan here and there erected small pyramids or cairns of stone, especially at *Chuta*, at *Camp I* and at places where our expected mail-runners could be in doubt which valley they had to follow. These pyramids will be found by future travellers.

The slopes facing the east and south soon become free from snow. A little higher up the bottom of the valley was still snow-covered. The guides took us up to a threshold or saddle which proved to be secondary. Here the ground is absolutely barren and very treacherous as the animals at every step sink down in the wet, soft mud, which is so much the more tiring as the slopes are very steep. Here the crevices in the soft ground are very readily visible, forming two systems of regular lines crossing each other, the one radiating and curved like the leaves of a palm-tree, the other concentric. There are also lines along which gravel of different magnitude has gathered, some coarse, and some fine. On these tremendous heights the mountains may indeed be said to be rotten and showing a very far advanced degree of decomposition.

From this secondary threshold there are still some very steep slopes to be ascended before one arrives at the saddle of *Chang-lung-yogma* at the height of 5,780 m. The pass is, therefore, about 120 m. higher than the *Kara-korum* Pass, whose absolute altitude, according to my observation in 1902, is 5,658 m., and which, therefore, and for morphological reasons is more easy than the *Chang-lung-yogma*. On the pass, living rock finally cropped out, and proved to be sandstone as before, and very rotten.

The way up to the pass, such as it presented itself from *Camp I* towards N.  $14^{\circ}$  W., is to be seen on Panorama 12, Tab. 3. I ascended a hill situated some 50 m. just above the pass, from which a more commanding view was to be gained. It is, however, extremely difficult or rather impossible to take one's bearings and whereabouts from this enormous height, though the view, as a picture, is certainly one of the most magnificent in the whole world. There is nothing to be recognized, neither peaks nor valleys, except the one we just have travelled up and which is to be seen to the S.  $12^{\circ}$  W. Still this view, of which Panorama 11, Tab. 2, gives only a very slight idea, is more fascinating than anything else during the whole journey, as it commands such an enormous area of the earth's surface.

A nearer study of this Panorama is interesting. It embraces the whole horizon, as I have started sketching straight south, gradually turning around to the west, north, and east and back to south. It should be remembered that I am standing on the crest of the water-parting *Kara-korum* Range. I am standing on a saddle, the absolute height of which is only perhaps one or two hundred meters lower than the neighbouring parts of this crest which is levelled by weathering to a general height that, so far as the eye reaches, is not surpassed by any peaks; at the most, by comparatively low cupola-shaped protuberances of the crest itself. The *Kara-korum* heights in the neighbourhood of my standpoint are easily seen on Panorama 11, of which they form the foreground. The crest of the water-parting protuberance of the *Kara-korum* is stretching to the N. W. towards the *Kara-korum* Pass. Of this the

Panorama shows the nearest part, N. W. of the *Chang-lung-yogma* Pass. It continues to the S. E., where we see some of the culminating ridges in the vicinity. In this direction, towards the interior of High Tibet, the water-parting system no doubt becomes comparatively lower and more irregular. To the N. N. E. high mountains could be discerned in the very great distance, but on account of clouds, were not clearly visible. The plateau-land of *Aksai-chin* could not be seen. It is probably hidden by smaller ridges not far away, and partly also by clouds. The gigantic peaks of the *Kara-korum* Mountains are hidden by the water-parting range, and even if no such obstacles existed, they would perhaps be invisible on account of the great distance. The grandest view is, however, to the S. W. and south, where the horizon was perfectly clear and no clouds covered the mountains. One gets the impression of a sea during a storm and with gigantic waves. There are thousands of peaks and ridges all snow-covered, white in the sunshine and blue in the shadow. Even the farthest peaks on the horizon are sharp and there is nothing like a perspective disappearing in mist far away. Everything is as sharp and clear as crystal. Perhaps it would be possible to identify some of the highest peaks with the help of the map. But it would be useless and the purpose of this Panorama, which also has to be thought of as a closed ring, is only to give a general idea of the view of this world of mountains. At most other saddles situated at 5,780 m. or more, the panoramic view will as a rule be somewhat of the same kind as this, a white sea of snow-covered mountain ranges and peaks, but with a horizon as even as that of the sea. For, at the first moment, one is surprised to find the line of the horizon nearly as level as that of a sand desert, disregarding its similarity to a very fine saw.

On the water-parting *Kara-korum* Range, on both sides of our pass, living rock is extremely rare. The place from which I sketched was, with one or two exceptions, the only one to be seen. The whole range appears as a flat, rounded protuberance of soft, fine material, enormous heaps of detritus, which only here and there allow some little part of the solid stone skeleton to crop out in the open air. All the rest of the living rock is in these high regions covered by detritus. But it would be very wrong to imagine the range as a comparatively regular crest, stretching in a nearly straight line to the N. W. On the contrary, it is extremely irregular, as can be seen even on my Panorama. The water-parting line of the range is winding in all possible directions, and, according to the laws of erosion, these irregularities are increasing in the course of time. Both the N. E. and the S. W. sides of the range are cut through by innumerable small valleys, every one of which has its origin in the crest of the range, and cuts its furrow deeper and deeper down into the mountain side. This excavating activity has been at a very high rate of energy in pluvial time, and during post-pluvial time it has gradually diminished, but is still going on, though at a much slower rate. The greatest amount of precipitation falls on the S. W. side,

on account of the condensation of the monsoon clouds. The valleys on the S. W. side are also, as we have seen, cut very deep. The erosive activity has been much greater in them than in those on the N. E. side. Or in other words, the relative differences of altitude are much greater on the S. W. than on the N. E. side. The small transverse valleys which go down at the N. E. side have a very gradual fall towards the centre of a self-contained basin on the high plateau-land. The amount of water flowing down through them is not great. The relative difference of altitude between the crest of the *Kara-korum* Range and the general surface of the plateau-land, is very small, as may be seen from the first marches to the N. E. from *Chang-lung-yogma*. Seen from the plateau-land the water-parting *Kara-korum* Range may rather be called a slightly elevated edge of the plateau-land itself, and by no means as a considerable mountain range forming its boundary to the S. W. On the S. W. slopes of the range, on the other hand, even the small valleys develop a respectable amount of erosive energy. Their gradients are much steeper, they receive the greater part of the precipitation, and they cut down their furrows to a greater depth. Therefore, the water-parting range of the *Kara-korum* appears from the S. W., as we saw in the *Spanglung* valley, as a considerable and bulky mountain range, though without any high, snow-covered peaks which could at all be compared with the giants situated on the second, or highest *Kara-korum* Range, which is to be found on the S. W. side of the water-parting line.

What I have discussed here are general rules derived from the observations made during my crossing over the *Chang-lung-yogma* Pass. The same observations could be made during my second crossing, over the *Dapsang*, nearly 1½ year later. To a certain extent they may again be made on the *Kara-korum* Pass, though there the morphology is somewhat different. This is nearly all that can be said with any degree of certainty. And how very little is it not when compared with the enormous extent of the water-parting *Kara-korum* Range! Honestly we may say that we know only perhaps a dozen points on the water-parting line itself! We, therefore, have only a very slight and vague idea of its situation, and if we try to make a map of it, most will have to be drawn by interpolation and consist of mere guesswork. If so little hitherto has been conquered, it is easy to understand that there is work enough to be done in the future. Hundreds of thousands of small valleys take their rise from the range. A minimal number of them is known. And there are many great valleys which have not yet been visited and, much less, mapped.

From my standpoint above the pass, lines of mud-flow could again be seen in the soft, wet material on the slopes. Only about one fifth of the area of the ground near the pass was still snow-covered. The panoramic view from the pass itself was far less dominating than the one I had sketched.

In these high regions there was no trace of a path. One has to consult the compass, the morphological features and the existing maps. From the pass a little valley goes down to the N. E., N. and again N. E. It is bounded by comparatively low hills, and in its middle there is a little brook. The fall is extremely slow. There is no kind of vegetation. The ground of the valley is very fatiguing, for it is a quagmire of soft, wet mud mixed with some gravel, in which men and animals sink a foot and a half at every step. The mountains consist of soft material and are more like heaps of detritus. They are low and their forms rounded. Sometimes very small brooks enter from the sides. At the point where the valley turns to the E. N. E., a valley joins from the west. In the corner of the junction a cairn was built, perhaps very old. It may be that the valley from the west comes from *Chang-lung-barma*, a pass which, according to the natives, was situated at a very short distance N. W. of *Chang-lung-yogma*. Our valley becomes somewhat bigger after the junction. The journey goes partly on the slopes of the hills at the left side, partly in the bottom of the valley. From the snow-patches on the sides, small brooks trickle down, to the greatest extent sub-terranean. In every hole after the animals' feet, grey water gathers at once. The main brook grows slowly; it flows perfectly silently, not forming rapids at a single place. The valley is winding in all directions. The living rock is as rare as before, and consists of grey sandstone with patches of rust. *Camp II* was pitched at the entrance of a tributary valley from the left, which also has a little brook. There was no grazing whatever to be found, and could not be expected on a height of 5,552 m.

*September 2nd.* The distance to *Camp III* is 19.2 km. to the E., N., and E. The fall in this distance is 170 m., as *Camp III* is at a height of 5,382 m. The rate is, therefore, 1:113, which is indeed very gradual for the slope of a gigantic mountain range. As a matter of fact it cannot be noticed with the naked eye. The form of the mountains around *Camp II* will be seen on Panorama 13, Tab. 3.

The march goes along the brook in the winding valley in front of which, *i. e.* east of *Camp II*, there is a mountain group with steep sides and some living rock at its upper part. The rest of the surrounding mountains are low and rounded. The valley turns in a semi-circle around a mountain, from which several subterranean brooks come down betraying their existence by the dark colour of the ground above them, which also is soft and treacherous. The brook, at the right hand of our route, flows close along the foot of the steep mountain mentioned above. At the point where we again reach the brook there was a cairn 1 m. high and covered with a flat stone. It was old. Other *nishans* in the valley had been erected by my own men. The living rock, cropping out at the left side, was grey sandstone as before, slightly quartzitic and with patches of rust.

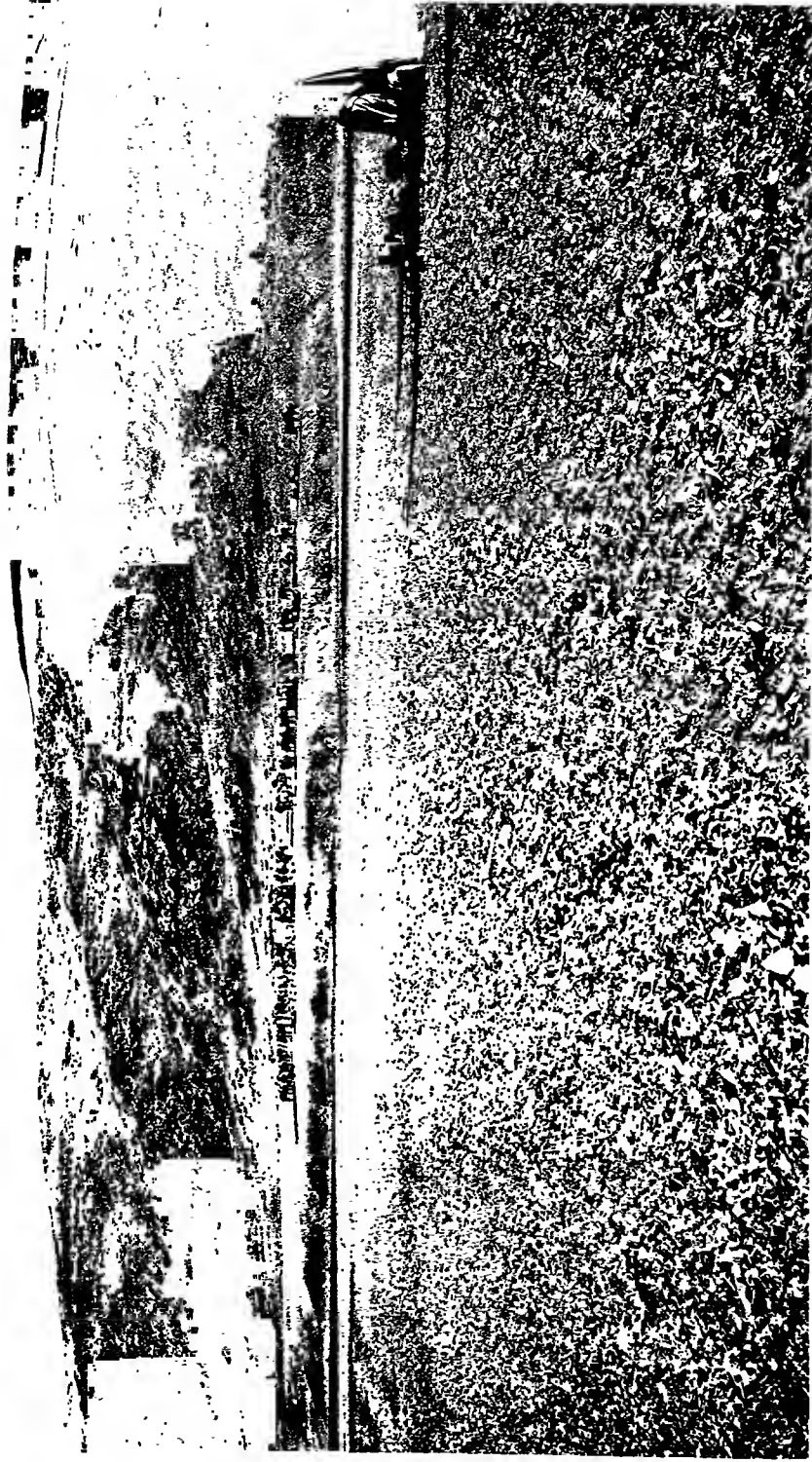
The country is hopelessly desolate. There is absolutely no kind of vegetation and no sign of life of any kind, not even dung of the wild yak. Skulls of yak and horses were, however, to be seen at some places. They may have belonged to animals in the service of the Forsyth Mission or surveyors of the Survey of India. The valley becomes broader and opens up. Its floor is more comfortable than hitherto, as it is covered with fine, dry gravel. The distance between the mountain ridges at both sides becomes greater. At intervals the brook is crossed. The water flows extremely slowly, sometimes it seems to be nearly immovable, and in side branches which have been cut off, it is quite still. Finally the valley goes out into a plain with perfectly dry ground, so dry even that dust clouds are whirled up by the caravan in spite of the hail showers which often beat the ground. At some hard places sufficiently elevated to be out of reach of running water, there were traces of an old track, though it was impossible to tell whether it was made by caravans or wild animals. It seemed to be old and had disappeared for long distances.

Again the brook is crossed and left to the left of our route where it flows along the base of reddish hills of soft material. Having crossed the alluvial plain, as barren as the rest of the country, we pitched *Camp III* on the left erosion terrace of the brook, at the foot of low hills. From this point a Panorama (14, Tab. 3) was taken of the surrounding region except from N. N. W. to S. E., where the hills quite close to the camp, hindered the view. To the N. W. the red hills are seen, at the base of which the brook is streaming, here divided into several branches. From N.  $75^{\circ}$  W. to S.  $89^{\circ}$  W., through an interruption in the near hills, a series of gigantic snow-covered peaks are seen, obviously a part of the S. E. continuation of the high *Kara-korum* Range, viz. the part of it that is situated to the west of the upper *Shayok* River. The rest of the range, to the N. W., is hidden by the above-mentioned red hills. To the W. S. W. the opening of the valley, by which we have come, is visible. To the S. W., south, and S. E. there is a series of more irregular, rounded hills, which constitute the last ramifications and foot hills in the direction of the water-parting *Kara-korum* which we had just crossed in the *Chang-lung-yogma*. Behind these hills, and hidden by them, the crest of the upheaval of that range is situated. Now one had indeed the impression of camping on the high Tibetan plateau-land, and of being surrounded only by relatively low mountain ridges, isolated, interrupted and irregular. Only to the W. N. W. and west the view reached some 120 or 130 km. away.

The living rock cropping out at *Camp III* was greyish brown limestone.

The march to *Camp IV*, *September 3rd.*, took us E. S. E. and east for 17.7 km. The height at *Camp IV* being 5,284 m., this means a fall of only 98 m. or a rate of 1:181. To the naked eye the ground, therefore, is practically level.





CAMP 2, N. E. of CHIANG-LUNG-YONGMA.



To the S.  $30^{\circ}$  E.—S.  $80^{\circ}$  E. a range of high, solid mountains now begins to become visible. From *Camp III* only their highest peaks had been slightly visible, as is seen on Pan. 14, Tab. 3, to the S.  $54^{\circ}$  E. They no doubt belong to the water-parting *Kara-korum*.

We leave the main brook at some distance to the right, and cross a little tributary brook, which disappears in the reddish brown gravel of the slope before it reaches the main brook. In the morning it was covered with ice. To our left we have low irregular hills. The ground consists of fine, red dust, which near *Camp III* was arranged in square, circular or polygonal figures separated from each other by belts of gravel up to one decimeter in diameter. These as well as numerous fissures in the barren dust soil, appeared to be due to the same phenomena of gravity and pressure in the soil which give rise to mud-flow. Fine gravel up to 1 cm. in diameter and rounded by water, also covered certain parts of the ground. East of some small hills the ground is covered by innumerable yapkak plants which now become common the whole way to lake *Aksai-chin*.

The weather in these high regions is strange. At 9 a. m. a rather heavy snowfall hindered the view all around and made the ground white. It lasted for an hour and changed the landscape into perfect winter. After another hour there was no sign of snow left on the ground, which in the very dry air quickly dries up. The heavens, however, continued to be covered by extremely thick and picturesque clouds, blue, grey, and nearly black. To the S. E. the *Kara-korum* peaks appeared again. One would have expected to find their slopes quite white after the fresh snowfall, but they were as black as before, and the lower edges of the eternal snow-fields had not noticeably changed their outlines. The wind came from the S. W. and the cloud masses sailed to the east.

The valley of the brook is wide and open. From the south it receives a little tributary from a transverse valley on the N. E. side of the *Kara-korum*. There are no human signs, and no cairns are seen, since we, near *Camp III*, had seen a 3 m. high wooden pole still standing upright from a cairn, and probably being a mark of some surveying party. The ground is dry, but very soft, and the track of our caravan, therefore, visible for long distances. At three places we crossed antelope tracks, and once saw the animals themselves, the first wild life met with on the plateau-land.

Having crossed the slightly undulating plain, we entered a series of small hills, and partly marched on low ridges, from which the view was free both to the north and south. The living rock was greyish brown, dense limestone as before and obviously predominating in the region. Far to the north rather considerable mountains were seen, no doubt belonging to the alpine regions where the *Kara-kash* and *Yurung-kash* have their sources. The yapkak plants continued during the whole day's

march. At *Camp IV* we were surrounded by relatively low mountains on all sides. Those to the north and west were in our immediate vicinity and are, therefore, not entered on Pan. 15, Tab. 3. The most interesting features of this panorama are the high peaks covered with eternal snow, which are visible to the S.  $22^{\circ}$  E., S.  $32^{\circ}$  E., and S.  $39^{\circ}$  E., and some other peaks situated on the same range. The peak to the S.  $54^{\circ}$  E. on Pan. 14, is identical with one of those just mentioned; though as only the culmination point of it is to be seen, it cannot be identified. The peaks of Pan. 15, certainly belong to the water-parting range of the *Kara-korum*, and rise above all other mountains which may be seen from *Camp IV*.

On *September 4th*, the march goes to the N. E. and east 22.2 km. *Camp I* is at an altitude of 5,206 m. or only 78 m. below *Camp IV*, which signifies a fall of the ground of 1:285. This day's march as well as the previous ones all the way from *Chang-lung-yogma*, followed the course of the little nameless brook which had its origin in the pass. The greater the distance from the water-parting range becomes, the more level is the plateau-land. Even three and a half days' marches from the range we are only 574 m. below the *Chang-lung-yogma* Pass. Therefore it is easy to understand that those parts of the range where we crossed it, as seen from the interior of the plateau-land only look like a rather low ridge. But we have also seen that farther S. E. there are several high summits on this range covered with eternal snow. It is, therefore, not to be regarded as a mere fairly regular and rounded upheaval along the whole of its length. But it is too little known, and I can only direct the attention of future travellers to this important orographical problem. All that I could see of the continuation of the range into the interior of Tibet, is shown on my panoramas 14, 15 and 16. Unfortunately the weather was so unfavourable that for several hours nothing could be seen of the far away mountains, and I, therefore, perhaps missed some good occasions to take bearings on their peaks. So, for instance, the high peaks of Pan. 15 were hidden during the next day's march.

As soon as we have left the small hills of *Camp IV* and passed the last projecting cape, the great plain opens up to the N. E., and seems to be perfectly level. The brook has disappeared to the right for a while, and there are no other water-courses indicating the direction of the fall. The first few kilometers the ground was very good and not too soft, though it consists of dust with very sparse, fine gravel. But in the neighbourhood of the brook which we approached again, the soil was a quagmire which was absolutely impossible to cross. Such stripes of wet, muddy soil were afterwards, with some difficulty, crossed at two or three places. They betrayed their existence from the distance by the dark colouring of the surface. Otherwise, the plain had a lighter greyish or brownish colour.

Between 9 and 11 a. m. two snowstorms swept over the country towards the N. E. In a moment everything became white. Nothing was to be seen at the sides.

We were lost in darkness on account of these heavy black clouds. The change of climate since *Chang-chenmo* was tremendous. The thunder was rolling over the *Kara-korum* to the south. Such storms last for from one half to one hour. It is of interest to remember that I, in 1896, at the very same season and in the N. E. parts of Tibet, experienced exactly the same weather, which seems to indicate that these storms sweep over the whole country diagonally from one end to the other. It is difficult to say whether they play an important part or not in the denudation and decomposition of the mountains, for the snow and hail that comes down with them, very quickly evaporates, and does not contribute to the formation of brooks to any degree worth mentioning. In spite of their regular occurrence at this season, the air is extremely dry, and water very rare. The brook we now followed, for three days and a half in all, was the largest we saw for a very long time, or until we reached *Bogtsang-tsangpo*. And we have seen how very small and tired, nearly dying, this brook was. Its existence is, however, explained by its neighbourhood to the mighty *Kara-korum*, on the other side of which the feeders of the *Indus* have their origin. In the winter the brook is completely frozen and quite dead. Only in the beginning of the summer, when the snows of the water-parting *Kara-korum* melt, it will be in flood, though never reaching any considerable size. Farther N. E. water becomes more and more rare, and sometimes it may be difficult to find a sufficient supply for ourselves and the animals.

We cross a very low ridge of hills. There is no living rock to be seen, and not a stone as big as a fist the whole day. Everything is dust or fine, sparse gravel. Beyond the ridge the ground again is comfortable and even. Two sheets of yellow clay, as even as the floor of a dancing-room, are passed. During a short interval of clear weather one could get a glimpse of the surroundings. To the east and west the country was perfectly open, indicating a latitudinal valley of the same kind as those which are so common in central and eastern Tibet. It was, however, impossible to see whether it turned N. W. and S. E. as would be expected from the general position of the mountains in these regions, or whether the plain we crossed was simply a local formation of the same kind as those which generally are called *Ling-shi-tang* and *Aksai-chin*. From the first sheet of clay two peaks were seen to the S.  $46^{\circ}$  E. and S.  $48^{\circ}$  E., the first of which was considerable, and covered with eternal snow. But they soon disappeared in clouds. To the north, at a distance of some 10 km., reddish rounded ridges partly covered with probably fresh snow, were seen, and to the N. W. at some 20 km. more considerable mountains with apparently eternal snow.

Finally we approached the brook, the left erosion terrace of which was 3 m. high, sometimes 5, and divided in two steps. The right terrace seemed to be here at some 200 m. distance, — lower down even at 300 m. Between the two, the brook

which carried a very small volume of water, was meandering from the one to the other. Clouds of vapour rose from its bed as well as from the little lake which now became visible to the E. S. E. Yapakak still grew in the region, though more sparsely. At the foot of the red hills to the south and S. W., such plants were very common. Three more snow-storms passed over the country, all from N. W. and S. W., and the whole ground now became covered with a layer of snow about 2 inches thick. Sometimes, when we had good weather, we could see such nearly black storms passing south or north of us, and making the ground white. The *Kara-korum* Mountains seemed to be more exposed than other parts of the highlands. In the afternoon we even had sunshine for about two hours. I made use of this for sketching Pan. 16A and 16B, Tab. 3, which gives an idea of the appearance of the country around *Camp V*.

This panorama begins in the W. S. W. and goes all around the horizon back to W. S. W. The low hills, visible a little to the left of W., are the hills south of the brook not very far W. S. W. of *Camp V*. To the west and N. W. is the open plain which is a part of *Ling-shi-tang*, and is traversed by the brook. From the N. W. over north and N. E. to east, there is a multitude of relatively low hills and ridges pierced by valleys and gorges, and with eternal snow on five or six more distant peaks. Through the valley close to the right of a peak N.  $23^{\circ}$  E. our next day's march proceeds. In the foreground between east and S.  $70^{\circ}$  E., where the latitudinal valley may be supposed to continue to the E. S. E., there is the little nameless lake, which is to be found on Pl. 1. Then again to the S. E. and south of the lake and at different distances from it, there is a labyrinth of mountain ranges and summits, the farthest of which, as for instance those to the S.  $5^{\circ}$  E. and S.  $2^{\circ}$  W., may possibly belong to the *Kara-korum* water-parting range. The mountains S.  $21^{\circ}$  W. to S.  $87^{\circ}$  W. of *Camp V* are situated only about 3 km. distant. All the way from S.  $62^{\circ}$  E. to S.  $87^{\circ}$  W., or the whole length of Pan. 16B, we see the very sharply marked right erosion terrace of the brook, which nowadays never is reached by the powerless rivulet, but still stands there very well preserved since the time when the brook carried down a very considerable amount of water, and the lake covered a much greater area than now. Everybody who takes the pain to examine this panorama and to compare it with the map and the absolute altitudes, will get a much clearer conception of this part of Tibet than through any detailed descriptions in words. Thus proceeding from one panorama to the next twice across the whole of Tibet, he will finally have a feeling of having crossed the country himself. In many cases he will recognize the same peaks on two panoramas near each other, and understand that the points where the lines of bearing cross each other give the situation of the peak on the map. In this way the panoramas have been a very valuable assistance to the Swedish officers who have constructed my maps. For

thoroughly penetrating my description of the topography and morphology of Tibet, it is, therefore, necessary to »read» my atlas of panoramas as if it were a book. The only difference is that the words and lines in a book are in this atlas changed into mountain-ridges and summits, the most important of them provided with bearings. As the words and lines of a book accumulate to a general description of a matter, so the panoramic lines of the atlas accumulate to a general illustration of the orography and morphology of the parts of Tibet traversed by my routes in 1906—1908. And as no book may be exhaustive of the matter it deals with, so my panoramas only represent a belt of varying breadth on both sides of my itineraries. But it may be said once for all that these 552 panoramas give a quite sufficiently clear idea of the morphological features of Tibet, even if the details, of course, always are changing.

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## CHAPTER III.

### THROUGH THE REGION OF AKSAI-CHIN.

On *September 5th* our route goes 19.7 km. a little north of N. E. About half way, there is a low pass threshold, dividing the self-contained basin of the nameless lake from the next basin to the north and N. E., which may be called *Aksai-chin*. From *Camp I* to the threshold, the distance is 11 km. and the height of the little pass is 5,367 m. or 161 m. higher than *Camp V*, meaning a rise of 1:68. From the pass to *Camp VI* the distance is 8.7 km. The height of the Camp is 5,110 m. or 257 m. less than the pass, thus having a rate of fall as 1:34, exactly twice as steep as the rise from *Camp V*.

Leaving the terrace on the left side of the brook we cross an extensive plain of yellow clay, the surface of which is somewhat deformed by wind and running water. Here and there it is crossed by winding watercourses directed to the brook, but now dry. This plain of clay has once been a part of the little lake as may be easily seen from a somewhat higher standpoint. As soon as the clay ceases, the ground becomes a little undulating, consisting of soft dust and some gravel and sparsely overgrown with the ordinary plants, which, however, vanish a little farther on. At one or two places we cross small, rounded terraces, about 2 m. high, obviously beach-lines of the lake from an earlier epoch. In the favourable weather now prevailing I got still more the impression that we were crossing a latitudinal valley of the first order, situated at the N. E. foot and tolerably parallel with the water-parting *Kara-korum* Range. The nameless lake belongs to this valley which, in the S. E., probably is separated by a comparatively low threshold from the S. E. continuation of the latitudinal valley. The lakes *Tsaggar*, *Arport-tso* and *Shemen-tso* may perhaps be regarded as belonging to the same depression, which here is more irregular and less parallel with the *Kara-korum*. But to these regions we shall have to return in due course. The *Chang-chenmo* valley is of quite a different kind as it crosses the *Kara-korum* diagonally. But the *Lanek-la* is, as we have seen, situated on the water-parting range.



As the ground gradually rises we finally become aware of a little lake to the S. E. A little farther on we again cross three well defined beach-lines and still farther on two large and several small ones. They prove that the lake, in the same way as *Lakor-tso* and many other lakes in Tibet, has gradually dwindled in post-glacial time. We could be here some 20 m. above *Camp V*. The erosion terraces of the brook are, therefore, a more recent formation than the beach-lines which also were more rounded and worn by wind and water.

The rise becomes more noticeable as we proceed up between the red hills of grey, dense limestone. From here it looks as if a long, narrow neck of mud or clay projected far into the lake from its northern shore, though it is difficult to tell whether this simply is due to the ordinary mirage of these regions or not. The chief water-course of the little valley was now dry, but not far from the pass there was a very small and perfectly clear brook, obviously coming from the last snow patches still left from the storms of the previous day. The rise up to the little pass is very gradual. On its broad and open saddle we are surrounded on all sides by comparatively low mountains (Pan. 18A and 18B, Tab. 4). To the N. E. is seen the valley by which we go down to *Camp VI* and *Aksai-chin*. Behind the mountains to the south the little lake is situated, now definitely hidden.

In the valley on the other side there is some scanty vegetation, the ordinary yapkak and even some poor grass. The valley is bounded by red, yellow and black hills of dark grey, dense limestone which is dominant in the whole region. In the middle of the valley there is a very little brook winding in a gravelly bed between erosion terraces 1 or 2 m. high. Of animal life there were now only two *Pantholops* antelopes to be seen, and excrements of a wolf. Wild asses or *kyang*, we had seen only once. A few ravens were always following the caravan. The valley slowly turns to the north, and in the same direction an extensive plain seems to be situated, beyond which a mighty black range with eternal snow is visible. The brook sometimes vanishes in the gravel of its bed, but soon again reappears. A comparatively large side valley enters from the right. Grass and yapkak becomes more frequent, and was, for Tibetan conditions, abundant at *Camp VI*, where everything was to be had: grass, fuel and water. From the camp the view was more hidden than from higher up in the valley. Pan. 17A and 17B represent the surroundings of the place. The most interesting is the view of the north, where the continuation of the broad, open valley is seen, later on turning to the left and emerging on the great *Aksai-chin* Plain. We had to proceed farther north to be able to see the high mountains belonging to the *Kwen-lun* System.

The day's march of *September 7th* was of great interest as it took us to a region of quite a different appearance than those we had left behind. The latitudinal valley of *Camp V* and the little lake had given us a presentiment of the great plains

we were now approaching. The march goes to the north, N. N. W. and west and the distance is 30 km. to *Camp VII*, where the height is 4,953 m., or a fall of 157 m. since *Camp VI*, a rate of 1:191. It should, however, be observed that the ground falls gradually all the way to the point where the direction is changed to the west, and where the altitude is probably only 4,900 m. From there, approaching *Camp VII* near the base of the western mountains, the ground again rises, imperceptibly to the eye, it is true, but still reaching 4,953 m.

From a climatic point of view the march was also extraordinary. There was no snow- or hail-storm, no wind, no clouds, the sun even burning hot, and, having left the little dying brook at *Camp VI*, we saw not a drop of water until we reached the spring at *Camp VII*. We, therefore, crossed a very arid and dry part of the plateau-land. The absence of running water indeed proves that this part of Tibet is always protected against precipitation. For even if snow- and hail-storms of the kind we had just experienced very often pass over the highlands, their precipitation vanishes, as we have seen, in the course of an hour, evaporating in the extremely dry air. At any rate the precipitation is not sufficient to form lasting brooks. Proceeding N. E. from *Chang-lung-yogma* we have seen how the running water became more and more scarce. The brook we had followed for three and a half days, and which goes down to the little lake, and perhaps is its principal feeder, carried, in spite of its coming from the *Kara-korum* water-parting, very little water. The brook from the low threshold vanished after a course of only 9 km. The farther we proceeded from the *Kara-korum* water-parting range the drier the ground became. This part of N. W. Tibet may certainly be regarded as the driest of the whole country, perhaps excepting the region around *Akato-tagh* in the far N. E. Those parts of the *Kwen-lun* System where the *Kara-kash* and *Yurung-kash* have their sources must, on the other hand, be rich in water. It is only the plateau-land between the two systems that may be regarded as an arid highland desert.

A short distance below *Camp VI* there was a little knoll of red weathered and rotten limestone, the only living rock within reach the whole day. Even gravel was very rare. The comminution of the debris had advanced as far as possible, and the whole ground consisted in fine, yellow dust, extremely soft and dry. In this soft ground there are millions of rabbits' holes. Yapak grew all over the plain with a few interruptions. On some slopes fairly good grass appeared. The plain which now opens up to our right is nearly level, and without instruments, since the bed of the brook has vanished, it would have been impossible to tell in what direction it falls. To the east the plain is bounded by low, red, rounded hills. Our route follows along the foot of the western hills, which, at one place, had a nearly vertical slope. Turning N. N. W. we have a very extensive plain in front of us to the north, bounded by a range with some snow. The bed of a dry watercourse is directed



THE RIDGE ABOVE CAMP 8.





A CAIRN BUILT BY MY MEN AT ONE OF OUR CAMPS IN  
NORTHERN TIBET.





A CAMP ON THE ROAD TO AKSAG-CHIN.





to the N. E. Farther on a greater bed is crossed directed to the N. N. W. From this the ground rises extremely slowly to the base of the eastern hills. As it appeared to be hopeless to look for water in the direction we had followed, we turned to the west where the ground was green. On the way westwards the plain was furrowed by some great erosion beds proving that sometimes a considerable amount of water comes down from the western mountains. At *Camp VII* grass, yapkak and water was to be found.

During the day's march two fragmentary and one complete panorama were sketched from the points which on Pl. 1 are marked  $P^1$ ,  $P^2$  and  $P^3$ . Though the country is rather monotonous in our neighbourhood, the views at a greater distance belong to the most magnificent in the world. To the north we have the ranges where *Kara-kash* and *Yurung-kash* take their origin, to the south and S. E. the continuation of the *Kara-korum* which here no more is a water-parting between the Indian Ocean and the self-contained plateau-land of Tibet, but a mountain system, the direction of which becomes more and more E. S. E., just as the *Himalaya* farther south. Between the two gigantic systems, *Kwen-lun* and *Kara-korum*, extends the high plateau-land which we are crossing. To the east and west we have comparatively low red ranges and ridges rising on the plateau. Beyond those to the west, and at no great distance the *Kara-kash* River has its sources north of which I would pass in January 1908. The most interesting feature of Pan. 19.1, Tab. 4, is the mighty range visible from S.  $78^\circ$  E. to S.  $11^\circ$  E., consisting of a series of cupola-formed and pyramidal peaks in light pink colours and covered with dazzling white fields of eternal snow. Pan. 19.2 shows only the mountains to the S. W., west and N. W. On Pan. 19.3 we see between N.  $15^\circ$  W. and N.  $15^\circ$  E., at a considerable distance, the mountains beyond which the *Yurung-kash* is streaming in its deep-cut latitudinal valley, and where the *Kara-kash* turns its sharp bend towards the east. The high peak to the S.  $54^\circ$  E. is marked on Pan. 19.1, and thus belongs to the *Kara-korum*. It should, as always, be remembered that Pan. 19.3 has to be imagined as a closed ring, which altogether changes the perspective. The panoramas stretched out horizontally give the impression of a continuity which does not exist in nature. Only when the drawing is imagined as a circle, one will realise that the high mountains north and south are two different systems more or less parallel with each other.

The march of *September 8th* takes us 12 km. N. N. E. The ground falls, though extremely slowly, in this direction. *Camp VIII* is at 4,916 m., or 37 m. below *Camp VII*, giving a fall of only 1:324.

As water is very rare, one has to take a supply along in the water-skins. The plain consists of fine, yellow dust as before with sparse yapkak plants and innumerable rabbits' holes. Kyangs and antelopes are often seen, and sometimes the wild yak's dung. Erosion furrows carved out by running water are very rare.

But at many places one sees that great volumes of water have washed over the ground without forming regular furrows. Gradually the ground becomes more and more barren, there is no more yapkak and no rabbits' holes. The dust is more reddish and sometimes covered with fine gravel. With the sun behind them, the *Kara-korum* Mountains now have a more greyish tint but towards evening they again appear in a tone of pink.

The mountains bounding the plain to the east, project like a promontory to the N. W. We marched towards this promontory with the intention of turning east on its other side. At its base there was an erosion bed which seemed to be directed to the north. The rock was greyish green sandy schist. Turning around the corner, *Camp VIII* was pitched at a place where the grass was the best we had seen since *Pobrang*, and where water could be had by digging small wells. At 1 o'clock p. m. the temperature of the air was 16.9°. The surface of the sandy ground had by direct insolation a temperature of 28.8°, and where it was moist 21.2°. At a depth of 10 cm. in a well I read 10.9°, at 30 cm. 7.0°, and at 55 cm. 5.9°. No precipitation had fallen during the day, though the heavens became covered by clouds in the afternoon, and one could see the precipitation on the high mountains around. It seems as if the arid plain is protected by them.

From the point where the erosion bed was crossed 1 1/2 km. S. W. of *Camp VIII*, Pan. 22, Tab. 4, was taken to the S. W., west, north, and N. E. It represents the mountains bounding the *Aksai-chin* Plain in this direction.

The next day an excursion was made up to the top of the low hills south of *Camp VIII*. A valley with unusually good grass leads up between the hills. The rock *in situ* is greyish green sandy schist. The valley becomes steep before it emerges upon the top of the plateau-shaped mountain, which, seen from below, has a red colour. At the edge of the plateau one is 60 or 70 m. nearly perpendicularly above the plain. Here my men built a cairn which probably will be found by future travellers. On the top of the plateau the rock proved to be light reddish Barrémien-limestone with grey patches, grey dense limestone, and red calcareous sandstone. At the base of the plateau-hill fossils were found in reddish grey Cenoman-limestone. It proved to be Rudist individuals, which Professor Douvillé places near the *Praeradiolites Fleuriani* from the Cenoman of Mans. The limestone of this region, therefore, should belong to the upper Cenoman. All the specimens of rock from my itinerary are described by Professor Hennig in Vol. V.

From a dominating point of the plateau some 4 km. S. E. of *Camp VIII*, I sketched Pan. 23A and 23B, Tab. 5, which goes all round the horizon and partly embraces rather distant mountains. Only in the direction of the next day's march, *i. e.* to the east, the distant view is somewhat hidden by the eastern continuation of the plateau itself. To the S. W. is the plain we had just crossed in search of water,

and to the west and N. W. is the greater plain with which it stands in uninterrupted communication. To the N.  $37^{\circ}$  W. is a very small round or oblong lake, the water of which is salt as can be seen from the broad white ring all around it. It must be extremely shallow as the surrounding ground is quite level. In its N. W. continuation there are two small round patches, now without water, as probably would soon be the case with the first-mentioned lake. To the N. E. there is still another small lake, the outlines of which could not well be discerned. It looked as if it had been divided into two basins, though this may be an effect of the mirage, or of low hills on its shore. At some places on its shore the ground was white with salt. The *Yurung-kash* Mountains of the *Kwen-lun* now appeared a little nearer than on Pan. 21B. Just beyond the last-mentioned lake they were partly hidden by nearer lower hills.

On *September 10th* our route goes 17.5 km. E. N. E., east and E. S. E. The height at *Camp IX* is 4,914, or a fall of only 2 m. since *Camp VIII*. The ground of the plain may, therefore, be regarded as practically level. The day was like a summer day, without clouds and wind. Still the air is not absolutely clear, though it is difficult to tell why. Because of the strong and intense insolation the ground becomes rather hot and above it one sees the fine vibrations of the air like those above a heated boiler. The hot air has a tendency to rise, and perhaps these vertical currents take some of the finest and lightest particles of dust with them. If this be the case the dust, however, does not reach very high into colder layers of the atmosphere, for it is easy to see that the upper parts of the mountains are sharper and clearer in outlines and colour than those near the base. Layers of air of different temperature may also cause the very common mirage. Very often the mountains seem to be reflected as from the surface of a quiet lake, where no lake exists. Parts of the caravan marching at a distance appear double, as if they were marching on the shore of a reflecting lake. The same seems to be the case with kyangs and antelopes, which now are more common. The whole country appears in light, aerial tones. No bright colours are to be seen, except the marine blue lake of *Aksai-chin*, which soon becomes visible to the east, and the limestone hills to the south, which are red. Otherwise the colours are softened and diffused. To the right of our route the limestone hills continue, as steep as before and with more or less projecting spurs. At one of them a curious pillar was standing and looked as if it had been built by men, though it was only a result of weathering and erosion.

To the east the view is free and open as far as the eye reaches. We have entered one of these characteristic longitudinal valleys which I knew so well from regions farther east. This one is remarkable as it is in connection with the more meridional Plain of *Aksai-chin*. It has been visited by Crosby and Angineur in 1903, and one day's march farther east, by M. A. Stein on his journey in 1906—8.

Nearly everywhere along the foot of the limestone platform there is comparatively good grass and yapkak. The whole ground is, therefore, pierced by rabbits' holes, which are a nuisance, causing the ponies to stumble continually.

At the spur where our direction changes to the E. S. E., the country becomes still more open to the east, and one gets a very strong impression of this enormous latitudinal valley, which I at once recognized as the one, in which Wellby, in 1896, farther east, had discovered his *Lake Lighten*. For at least four days' distance the ground appeared to be nearly level, except for small transverse thresholds between neighbouring self-contained basins. Such a threshold, though imperceptible, must be situated between the Lake of *Aksai-chin* and the little lake just west of it. The breadth of this enormous latitudinal valley seemed to be about the same for a very great distance, or about 10 or 12 km. across. At some four days' journey east a snow-covered mountain rose, though it was still impossible to tell whether the valley lay north or south of it. The valley obviously continues to the N. W., including the northern part of *Aksai-chin*. And still farther N. W. there are other latitudinal valleys which certainly stand in some tectonic relationship to the one we now are considering. Such valleys are a part of the upper *Kara-kash-daria* and the upper part of *Raskem-daria*. The great latitudinal valley is no doubt the first of its kind situated south of the *Kwen-lun* System. But in the interior of this system there is another latitudinal valley parallel to it, namely that of the upper *Yurung-kash*. The latter is, however, of a quite different kind, for it is, at least to a large extent, an erosion valley, whilst the one in which we now are moving, is purely tectonical. So far as we see, it is, on the north, bounded by a mighty range belonging to the *Kwen-lun* System, and to the south by mountains of moderate height.

Our route approaches the lake, and *Camp IX* is pitched at a short distance from the shore at 4,914 m., which is only two or three meters above the surface of the lake. Here the ground consisted of clay mixed with sand. Several small springs formed a minimal brook which did not reach the lake. The grass is excellent; yapkak and dung of yak and kyang abundant. Kyangs were visible in the region, and probably come to the springs to drink. To judge from the yak dung, these animals visit the place only during the winter. The water of the lake is bitterly salt; at 17.5° temp. the areometer showed a spec. gravity of 1.167. It is perfectly clear and clean. At a time not long ago the *Aksai-chin* Lake seems to have been fresh, for a low barrier of rotten and dry lacustrine plants and lake-weed remained along the shore, and two or three old beach-lines were to be seen. The latest of these was about 3 m. high. Near the camp a dry erosion bed goes to the lake. At the shore the clay was blue and plastic; some 200 m. from the shore the ground consisted of white clay with remains of plants. As the ground in the latitudinal valley all around is very level, the lake must have been much larger when even



THE AKSAI-CHIN. IN THE BACKGROUND, TO THE N.E. AND E.N.E. SOME SNOW MOUNTAINS BELONGING TO THE KWEN-LUN SYSTEM.



only 3 m. higher than now. It may easily have had an effluent to the lake in the west, or, if it has been in connection with it, to some now dried up depression farther west. It partakes, of course, in the general desiccation of all Tibetan lakes.

The panorama 24A and 24B, Tab. 5, taken from *Camp IX*, again gives a quite different view from the previous ones, and introduces two new characteristic features in the Tibetan plateau-landscape. One is the Lake of *Aksai-chin* which dominates half the foreground with its brilliant blue sheet of water. The other is the opening of the great latitudinal valley. Between a few degrees north of west and N.  $59^{\circ}$  W., there are no mountains visible, only the gradual slope or very flattened scree at the northern foot of the limestone mountains we had passed along from *Camp VIII*. Between N.  $89^{\circ}$  E. and S.  $86^{\circ}$  E. one only suspects, because of a low blue rim above the horizon, that mountains, or perhaps only a flat threshold will be met with somewhere very far to the east. The mountains north and south of the lake appear in all their details. Of the great *Kwen-lun* Range nearly nothing is visible as the standpoint is too low.

On *September 11th* we continue E. S. E. a distance of 25 km. The ground is nearly level, for *Camp X* has a height of 4,894, or only 20 m. below *Camp IX*.

Leaving the small swamps around the spring of *Camp IX*, we march along the edge of an old beach-line of the lake. For a short distance the ground is pierced by narrow furrows about one foot deep, which rather seemed to have been formed in connection with the desiccation than by erosion. The soil consists of the same kind of clay as we had found on the shore of the lake, which indicates that we are riding a few kilometers on old lake bed. The clay is here very soft, and the ponies sink 1 dm. or more in it. The tract is absolutely barren and salt. In a small depression some salt water stood. Other depressions were dry, and dry water-courses were directed to them. The ground seems to be like that the whole way to the foot of the scree at the base of the northern mountains; its colour in that direction is generally greyish, sometimes turning into dirty blue or yellow. All this proves that the lake in bygone time must have been much bigger than nowadays.

To the right or south a considerable transverse valley is opening. The mountains to the north were mostly hidden by clouds and hail. Sometimes slightly convex areas covered with gravel, 1 cm. in diameter, are crossed. Belts of clay are still passed, and we cross four beach-lines, mostly of hard, fine gravel, and of the same kind as the one nearest the lake shore. After having left all these old remains from the earlier extension of the lake, we enter a plain of hard sand and gravel with sparse yapkak plants. Through a broad valley between comparatively low mountains to the south, a considerable snow-covered group is seen. Other parts of it appear later on, indicating a range south of and parallel with our latitudinal valley. The distance to this range seems to be about 10 km. Its colour is light

red or pink, it is rocky and steep, and it seems to continue a long way east. Chiefly on the north side of its peaks, there is a good deal of snow. On this side of the range there are lower hills in red and green colours. The red ones seem to be of the same kind as, and the continuation of, the hills south of *Camp VIII*. Towards the north one may distinguish between three different gradations in the orographical arrangement: small disconnected hills of brownish colour; greater uninterrupted ranges of rounded forms and without snow; and finally a principal range with eternal snow.

The plain assumes a very curious character. To the eye it is as level as a frozen sea, hard and comfortable for marching, partly consisting of fine gravel in a thin layer of dust, and partly of sand. There are no erosion furrows and no kind of watercourses. It would be impossible to tell whether this plain were absolutely horizontal or whether it sloped in some one direction. More likely it rises extremely slowly to the east in spite of the absolute heights given above, which are liable to error on account of the ever changing atmospheric pressure. Finally we turn E. N. E. crossing a brook which belongs to the category of dying old watercourses. For in its bed the water seemed to be quite immovable, and only at a narrow place one could see that a very slow current was directed to the west. The water was slightly brackish, though drinkable.

*Camp X* is situated between two arms of this brook which probably comes to an end somewhere in the great clay bed we had seen to the north nearly the whole day. On account of the levelness of the floor of the latitudinal valley the hydrographical relation between the Lake of *Aksai-chin* and this brook is not quite easy to make out. The most probable would be that *Camp X* in reality is situated at a few meters above the lake and that the brook once was an affluent of it. Dry yapkak roots were abundant as well as grass. No signs of human visits. Only the day before we had seen an old fireplace consisting of three stones arranged as a triangle for boiling water in a pot. Of wild animals only kyangs and ravens were seen. The weather had changed to the worse; S. W. and W. S. W. wind with some hail showers, and the heaven covered by clouds. The beautiful blue colour of the lake had, therefore, disappeared, and it now had a grey, dull colour.

The Pan. 25<sup>A</sup> and 25<sup>B</sup>, Tab. 5, taken from *Camp X*, goes around the whole horizon and has a certain resemblance to the one from *Camp IX*, at least from a general morphological point of view. It is again the great latitudinal valley which is the dominating feature of the landscape with moderate mountains both to the north and the south. The western opening of the latitudinal valley is now seen to the N. 86° W.—N. 80° W. as a horizontal line without any mountains in the back-ground. The eastern opening is somewhat narrower than it was from *Camp IX*.



From *Camp X* eastwards the ground rises decidedly, and one does not need to be in doubt any more. During four and a half days' marches we come to higher and higher ground. The distance from *Camp X* to *Camp XI* is 20.5 km. E. S. E., and the rise is 42 m. or at a rate of 1:488. This fact seems to indicate beyond doubt that the Lake of *Aksai-chin* must be at a lower level than *Camp X*.

The branch of the brook which was crossed at a short distance east of the camp, was much bigger than the first, though it only carried about 2 cub. m. per second. Here the current was comparatively fast. The bottom of the bed was hard and consisted of sand and clay. Not the slightest trace of erosion terraces had been cut out. The depth was, at its maximum, one foot. On both sides several shallow beds without water were crossed. The moisture at their bottom seemed to indicate, that they had carried water a short time ago. Probably these beds change their position from time to time, otherwise terraces would needs be formed. Obviously the brook had carried a large volume of water during the summer. By far the greatest part of this water comes down from the high ranges to the north, which are covered by eternal snow, and follows the transverse valleys which open themselves into the great latitudinal valley. The hard S. W. wind which now prevailed, nearly stopped the current in some branches, and at one place a little lake had been formed in this way. Most of this hydrographic system, which is a very important feature of the latitudinal valley, remained to the south of our day's march and of the next two. The valley is rich in grass, especially to the left of our route. The soil is hard clay with some fine gravel on the surface. The latitudinal valley is very broad in this region, or at least 12 km. The nearest mountains on both sides are relatively low, those to the right are red, those to the north greyish green. The direction of our march is nearly east where the straight line of the horizon is very distant.

The chief branch of the brook is out of sight most of the day. It is, therefore, marked with a dotted line on the map. It may be that its course is situated farther south, and that it actually flows nearer the base of the southern hills. This would be caused by the northern mountains being higher and their screes richer in debris, thus forcing the brook southwards. The ground is now everywhere covered with grass growing in small tussocks or fagots. It is yellow and hard after the first frost and only in the centre of every fagot the straws are still green and soft. This is a regular steppe, and, I believe, the most favourable region I have ever visited in Tibet. One cannot imagine a more hospitable region to penetrate in the inhospitable Tibet. The ground is even and sufficiently hard, there is any amount of grass, there is fuel and water, and there are antelopes and kyangs. It is, therefore, a good plan to remain in the latitudinal valley to let the animals recover before beginning the diagonal crossing of the difficult country. The ground is now sandy, as sand and grass generally go together. At the lee side of every grass-tussock there

is a small accumulation of sand, but there is not even a rudimentary formation of dunes. The colours are bright: the brilliant yellow grass, the clear blue sky, the dark violet, greyish yellow and red mountains, the white snow-caps on the highest summits, and the black rocks below the snow.

The grass comes to an end and the ground is then covered with fine, black gravel. One of the transverse valleys to the north is considerable; its dry water-courses, however, are very diffused. Where we again reach a branch of the brook the grass is abundant, and the bed has a very low and rounded erosion terrace. On its other side there is barren sand with ripplemarks, but no dunes. Clay ground is also common. This alluvial region is curious. Wherever one goes there are signs of running water but the branches of the brook are meandering in all directions and in very undecided beds. Sometimes one gets the impression that the whole central part of the valley, to a breadth of several kilometers, is the bottom of a dying river, of which now only a few scant watercourses remain. Finally the ground consists of yellow clay covered by coarse sand or fine gravel of quartz grains of 4 mm. diameter as an average. This sand is arranged in great ripplemarks with a distance of from 1 dm. to 1 m. between the waves. The latter have obviously been formed by very strong winds, but they still show no tendency of accumulating into dunes. Now being moist, they were immovable. From *Camp XI* the chief branch of the brook seems to be situated near the foot of the southern hills, though the distance to them may still be considerable.

Panorama 26A and 26B, Tab. 5, is morphologically of exactly the same type as the preceding panoramas, though the open gap in the east marking the continuation of the latitudinal valley has dwindled to a very narrow space depending upon the configuration of the projecting spurs from the mountains north and south. Comparing the panorama with the map it seems as if this open gap ought to have been situated a little south of straight east, or about S. 80° E. The disagreement is caused by the corrections inflicted on the map from the astronomical points and from the topographical knowledge previously possessed regarding the country in general. I am sure that the bearings of the panoramas are more reliable than these corrections. In another part of this work Colonel H. Byström has discussed the great difficulties he has had in constructing the map of 1:1,000,000 on account of the discrepancies existing between the itineraries of different explorers. In connection with this observation it may be said that the panoramas give a much clearer idea of the mountains than the maps. In the former there cannot be any greater errors in the bearings than 1 or 2 degrees. When, in the future, the astronomical points will be duly corrected, and the situation of Tibet as a whole well fixed within the net of coordinates, the value of the panoramas will increase. The scientific conquest of this country will still take centuries.

On *September 13th* the direction is E. S. E., 14.5 km. to *Camp XII*, where the height is 4,981, or 45 m. above *Camp XI*, *i. e.* a rate of 1:322. The weather again was very unfavourable, and as a rule nearly nothing was to be seen of the mountains on the sides. Clouds and showers of snow and hail were continually driven up the valley. From this point of view as well, the panoramas are important. They complete the map where the view has been hidden, since panoramas are sketched, of course, only at hours when the air is clear.

The ground is now covered with coarse, grey sand. There is still sparse grass at some places, and a plant with a hard, wooden stem, called *jer-baghri*, in Turki, which is excellent as firewood. The hard clay ground is often traversed by narrow cracks and fissures of different appearance. Sometimes they open in the level ground, sometimes they are situated in minimal depressions, or between two small walls. At other places they cross small cupola-shaped upheavals of the ground itself. They had been seen at other places farther west as well. It is difficult to account for their formation. Perhaps they are simply local phenomena of shrinking or dilatation caused by changes of temperature and moisture and desiccation. But they may as well stand in some relation to orogenetic agencies still working in these high regions.

Marching eastwards for several days in such a gigantic valley as this, one continually expects to pass a transverse threshold sooner or later, and perhaps without noticing it. This could easily be the case in such weather as now, when nearly nothing is to be seen except the immediate vicinity, and when the ground to the eye seems to be perfectly horizontal. I knew how very low such thresholds were, separating self-contained basins in the great latitudinal valley I had travelled through in 1896 and situated far east, just north of the valley discovered by Wellby and Malcolm, the latter being the eastern continuation of the one I now followed. But it proved that the basin draining to the Lake of *Aksai-chin* was an unusually extensive one, and that we had still a long way to its eastern boundary. A journey along such a longitudinal valley as this, necessarily becomes extremely monotonous, especially in weather where all the details of the surroundings are hidden. One day's march is like the previous, and the only variation is the character of the soil and the appearance of grass and erosion beds. The only interest is in waiting for a transverse threshold, at the eastern side of which a quite new landscape will be seen.

*Camp XII* was pitched at the foot of a rounded mountain spur between two rather large transverse valleys from the northern or *Kwen-lun* side. Here grass, fuel and water were to be had. The water appeared in the form of a spring in a little depression. The living rock at the place consisted of greyish green calcareous sandstone. During the whole day one snowstorm succeeded the other, though the snow did not remain long on the ground which did not even become white. During

the interval between two showers I sketched a panorama to the south, the whole northern half being hidden by a spur near the camp. On this view, Pan. 27, Tab. 6, we see that the mountain range, or rather system of fairly irregular ranges south of the latitudinal valley, have grown higher than hitherto and show a tendency of increasing to the east. Several of these ranges and summits are covered with perennial snow.

To *Camp XIII*, *September 14th*, the distance is 13.5 km. nearly east, and the rise 37 m. only, or 1:365. To begin with, our direction is S. E. To the left we leave the mouth of a considerable meridional valley from the north, and it appeared that by far the greatest amount of water of one brook came down from that valley. It was divided into four branches, one of which was larger than the three others, and had erosion-terraces 2 feet high. Several other beds, now without water, were still wet. It is not surprising that such a comparatively large brook comes down from the southern side of ranges which on the northern side contribute to the *Yurung-kash* River. Now the volume of water could be about 3 cub. m. per second, perfectly clear and fresh. Probably it comes from a very mighty group, which had been visible for several days, and was situated N. E. of *Camp XII*. The brook had grown bigger every day, which is not surprising, as it, on its course downwards, loses a good deal of water by evaporation and in the ground, so much the more as it is spread in several shallow beds.

The mountains to the south are red, as hitherto, with violet patches. To the S. S. E. a snow-covered group is sometimes seen through the very foggy and cloudy air. The northern mountains are dirty greyish green, sometimes yellow from grass on the slopes. The southern mountains seem to be perfectly barren. The difference may depend in some degree upon the fact that the former are more directly exposed to the sun. Farther on, at clear intervals, we see to the south and S. E. a magnificent and wild pink-coloured range which seems to continue a long way to the east. It is to a large extent covered with snow which at places reaches down the slopes so far as one can see. Soon afterwards the whole landscape to the south vanished in black clouds. Once again an area of grass, forming a low convexity, was crossed and somewhat later a ring of grass reminding one of an atoll in the sea; it was only about 50 m. long east and west, and 40 m. across, the belt of grass being only 4 m. broad and also convex. Close to the right of our course we still have a watercourse, being the principal drainage of the latitudinal valley, but now containing only a series of mostly isolated pools. Farther east even the pools became rare. To the south of it there are steppes of scant grass with antelopes and hares.

The direction turns a little to the E. N. E. passing a projecting spur from the northern side, where the rock was light greyish green calcareous sandstone, grey limestone containing quartz, and light reddish calcareous schist. As usual living rock

is very rare. The nearest hills, as a rule, consist of small, rounded, strongly denudated ramifications covered with débris, and with screes of gravel on their base. The gravel here is sharp-edged. Still there is a good deal of grass growing here, and much dung of the common animals.

At the place where our direction turns E. N. E., the valley widens out considerably. We have a feeling of coming out upon a very great plain crossed by stripes of grass. To the N. E. a large transverse valley opens out, and from it the rest of the brook comes down. The plain is here covered with black gravel 2 cm. in diameter. To the south and S. E. the nearest red range is visible, but the high pink-coloured snow range is hidden. Pan. 29A and 29B, Tab. 6, give an idea of the view. On this panorama the open gap to the east showing the continuation of the latitudinal valley, is broader than before, whereas the gap to the west is hidden by the nearest projecting spurs from the north.

On *September 15th* we advance 14 km. a little south of east. The floor of the valley rises at a stronger rate than hitherto, or 1:92, as the height of *Camp XIV* is 5,170 m. or 152 m. above *Camp XIII*. During this new day's march the landscape remained as before, and hardly any observations worth mentioning were made. The only change was that the ground now ascended with a steeper gradient than before, though always very slowly. There is still a good deal of grass but no water, not even dry watercourses. The weather remained as the days previous, clouds and fog concealing the mountains around. Only occasionally a glimpse of them could be caught, showing that the southern mountains still continued red, the northern greyish green. Occasionally a shower of snow mixed with rain fell. The wind was easterly; the day before it had been north and N. W.; otherwise, S. W. and W. S. W. was the prevailing wind. Towards evening the air cleared up so much that a panorama could be sketched, 30A and 30B, Tab. 6. It gives a good illustration of the view around the quarters of the compass. The mountains to the north, N. E. and E. N. E. show their rounded forms and their uninteresting relief. To the E. S. E. is the transverse threshold of the latitudinal valley, beyond which *Lake Lighten* is situated. Between S. 74° E. and S. 51° E. we behold the culminating part of the pink-coloured range, which here shows itself in a foreshortened perspective, but next day would appear in all its splendour. To the S. E., south and S. W. there are several rather high peaks and ranges with eternal snow, belonging to the same well-marked range.

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## CHAPTER IV.

### THE KWEN-LUN LAKES.

*September 16th* finally brought us to and beyond the transverse threshold, which is the definite boundary of the self-contained basin that we had crossed ever since the little pass above *Camp VI*. And from there we reached the western shore of the great lake, baptised *Lake Lighten* by Captain Wellby, a name that now, fortunately, is abolished by the Survey of India. The direction of the march, 17.5 km., is chiefly E. S. E., only the last two or three kilometers are to the N. E. From *Camp XIV* we had 11 km. to the threshold, where the height was 5,273 m. or 103 m. above *Camp XIV*, thus giving a rate of ascent as 1:107. From the threshold to the lake the distance amounts to 6.5 km. The lake being situated at a height of 5,095 m., this means a fall of 178 m. or as 1:37, which is nearly thrice as steep as the slope on the western side.

Marching E. S. E. from *Camp XIV*, we cross the mouth of a very considerable transverse valley coming from the north. It took us three quarters of an hour to cross this opening, and during the whole of this time we passed a series of very wide and shallow watercourses, the beds of which were filled with fairly coarse gravel, partly granite. Most of these beds carried no water, but in eight branches, situated in the middle, about 1.5 cub. m. per second came down. In the background of the transverse valley a moderate range covered with snow appeared, and to the N. N. W. a rather high and sharp peak. The range is obviously the same one that stands on the left or southern side of the upper *Yurung-kash* River, or at any rate, ramifications belonging to that range. From the beds in the transverse valley it is easy to see that very considerable masses of water may flow down from the snow-fields of these mountains during the summer. It proved impossible to make out with certainty where this considerable brook went to. As far as could be seen it turned to the S. S. W. On the march from *Camp XIII* to *Camp XIV* it had not been in sight. Judging from the relief and the absolute altitudes of the region, it must, however, flow to the west and join the system of the brook we had followed the last days, and which no doubt belongs to the Lake of *Aksai-chin*. Under such conditions it seems



ON THE WESTERN SHORE OF LAKE LIGHTEN, CAMP 15.





probable that it flows along the foot of the southern mountains and joins the main brook somewhere near *Camp XII*.

Just east of the transverse valley there is a meridional threshold or saddle in the latitudinal valley. Beyond it another threshold became visible to the east. The ground here is sandy with some grass, and sometimes small blocks of igneous rock, probably granite, were seen. A second, smaller valley from the north had a little brook in the branches turning westwards. The ground rises slowly and is soft, with fine gravel on the surface. A third valley from the north had a perfectly dry bed filled with fine gravel and with an erosion terrace on its right side at least 4 m. high, proving that a rather energetic erosion had been acting here in bygone times. Only at some distance up in the valley a left erosion terrace was also to be seen. Protected by it there still was a stripe of fresh snow. From the mountains to the left, flat protuberances or simply scree are projecting southwards across the latitudinal valley; at each one of them one hopes it is the boundary of the *Aksai-chin* Basin, but every time there appears a new little threshold to the east. Three more little brooks come from the north. As far as we have been able to see, nearly all the water of the main brook comes from transverse valleys through the northern mountains. This is quite natural, for the northern mountains are mightier and higher than the southern and, therefore, catch more of the humidity brought by the monsoon. Still at so late a season as now, or the middle of September, the northern ranges are, on their southern slopes, more exposed to the sun, whereas the southern mountains are more in the shade. Already at the end of October these brooks will, no doubt, be frozen to the bottom.

The pink range to the south which from *Camp XIV* had appeared in a foreshortened perspective, during the course of the day's march unfolded its splendid panorama in all its details, its rugged ridges and wild peaks, its irregular snow-fields and its steep, rocky slopes in reddish yellow and pink colours of brilliant effect. On account of the fresh snow it was impossible to tell whether any rudimentary glaciers were formed. This fascinating range quite dominates the landscape by way of its unusually bright colours and its picturesque relief. At intervals the rising ground concealed the range. But as we finally reached the last transverse threshold at 5,273 m., it opened out in all its splendor. And north of it extended the intensely blue lake, which had been discovered by Wellby in 1896. Some 12 or 13 km. west of the lake was also the point where we entered Wellby's and Malcolm's route, which we followed for only 10 km., as they turned S. E. and marched along the southern shore, while my caravan marched on the northern shore, and I myself crossed the lake by boat.

This transverse threshold is important as it divides the drainage area of the Lake of *Aksai-chin* from the well-defined and comparatively small basin of *Lake*

*Lighten.* Standing on the pass one sees the last of the *Aksai-chin* Basin after having ascended slowly during six days, and to the east one has a quite new, very curious and much more beautiful landscape where the southern range and the blue lake particularly catch ones attention.

Just east of the threshold the living rock is greyish green calcareous sandstone. Farther on it is grey dense limestone. A little open valley goes down to the lake, and has a brook with some water, receiving still smaller tributaries from the left or north. The ground is swampy, and there is some good grass in the sand. The little valley turns to the N. E. To the S. S. E. the western end of the lake is visible. It looks as if both the southern and the northern mountains were falling steeply down into the lake, which is, however not the case as there is a more or less narrow plain between their foot and the lake. Along the western shore there is also a belt of even ground with sand, fine gravel, sparse grass and yapkak plants. Still, from the general morphology of this basin, one gets the impression that the depth of the lake must be considerable, and such is also the case, remembering that this lake is on the Tibetan plateau-land. On a little terrace of sand and grass, at the base of which springs came up, *Camp XI* was pitched some 5 m. above the surface of the lake.

The panorama, 31A and 31B, Tab. 6, taken from *Camp XV* is very interesting and shows the outlines both of the southern range and the lake. It goes around the whole horizon. Beginning from N.  $50^{\circ}$  E. we see a considerable valley coming down to the lake from the northern mountains. N.  $84^{\circ}$  E. rises a red mountain group with comparatively low depressions on both sides, one visible to the N.  $79^{\circ}$  E. where a distant peak appears, the other to the east being a red saddle. The northern one is probably the one taken by Stein on his journey in 1906—1908, the southern the one followed by Wellby and Malcolm in 1896. S.  $82^{\circ}$  E. is the last peak visible from here, belonging to the magnificent southern range, the highest tops and ridges of which continue in a long series from E. S. E., S. E. and south to S.  $9^{\circ}$  W. Compared with the map, Pl. 2, the panorama shows that the relief of the southern range is much more complicated and irregular than could be represented on the map, which only gives the situation of the range in rough outlines. The white parts of the panorama are snow, the shaded are rock in the glowing red, pink and yellow colours mentioned above. The névés and firns of the range are too small to be able to form glaciers. On this side, which faces the north, the eternal snow goes down to the very base of the mountains, and it is possible that glaciers would have been formed if the surface of the plateau had not been so near, viz. at 5,095 m. The highest peaks of the range may be at 6,500 or perhaps nearly 7000 m. Their relative height is, therefore, only 1,500 or nearly 2000 m., and the length of the slopes is too short to give space enough for the development of glaciers. This is,

however, not the decisive factor, for on Spitzbergen for instance, large glaciers are formed on much shorter slopes. If the enormous quantities of débris that have filled up and levelled the great latitudinal valley suddenly disappeared, the névés and firn troughs on the range in question would of course, still be insufficient to give rise to glaciers worth mentioning. The decisive factor is that the precipitation is not sufficient for feeding glaciers, and the evaporation is enormous in the dry air.

Between S.  $9^{\circ}$  W. and S.  $29^{\circ}$  W. some of the lower mountains are seen which are situated to the north of the great southern range. The little gap S.  $29^{\circ}$  W. is the slow ascent to the transverse threshold. The low hills to the right of it are ramifications from the northern side, altogether hiding the open valley in the direction of *Aksai-chin*. To the N. W., north and N. E. no high mountains are visible, except to the N.  $32^{\circ}$  W. where a great mass is showing its snow-covered head. To the N. E., however, a gigantic cupola-shaped mass with eternal snow was situated, though it was hidden by clouds when I sketched. In the foreground, looking south, extends the blue sheet of the lake. Nothing is to be seen of the narrow plain at its southern shore. One may nevertheless suspect the existence of such a shore-plain, as there is a gap between the base of the recent screes and the shore-line.

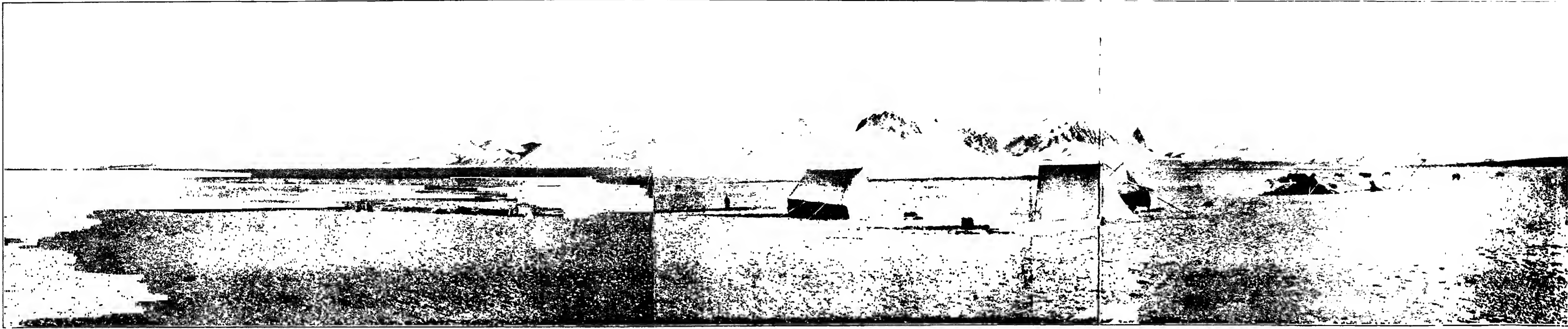
On the evening of *September 19th*, a regular W. S. W. storm blew over the highlands, and it was interesting to see how real clouds of sand and dust were carried away out across the lake. Theoretically one would expect that the western half of an oblong lake which fills out nearly the whole breadth of a latitudinal valley, and is exposed to the prevailing S. W. and W. S. W. wind, would be shallower than the eastern half of the same lake. This ought to be the case in a still higher degree when a nearly 200 m. high threshold is situated a short distance west of the lake. For on the lee side of this threshold the wind would lose a good deal of its force and the solid material carried by it fall down. But this seems not to be the case. At *Camp XV* the wind was very strong and the clouds of sand and dust were blown far away over the lake. A line of soundings, being nearly 9 km. in length, which I took between *Camps XV* and *XVI*, also proved that the lake was surprisingly deep in its N. W. part. The 1 m. isobathic line lay, it is true, at about 250 m. from the shore. Some 500 m. out we measured 6.6, after which we soon had 44 m., and then 45.2, and 48.5 m. A depth of 34.5 m. was found at only 200 m. from the shore near *Camp XVI*. At about 50 m. from the shore we had 3.8 m. Therefore, the 1 m. line is much farther out from the western shore than from the northern, which, in some degree, may depend on the wind-blown sand. The northern shore consisted of gravel, the last visible part of the scree from the northern mountains, which may be supposed to continue out into the lake.

At the western shore the water was as clear as crystal, and the bottom here consisted of fine gravel and sand with ripplemarks. No animals or plants were seen.

The water is slightly brackish, but drinkable in case of necessity. At the western shore where the little brook from the pass and several springs went out into the lake, the water was fresher than in the middle of the lake. Regarding the N. W. shore-line my men reported that the mountains north of *Camp XV* at one or two places proceeded very near to the shore, which otherwise was soft, undulating ground. In the gravel a beach-line was seen, of the same kind as the one at *Camp XV* or about 5 m. above the surface of the lake. At some places it was pierced by ravines, at others springs came up. To the north the level shore belt was fairly broad. At *Camp XVI* a brook flowed down to the lake, the bed of which seemed to have carried much water in summer and consisted of hard gravel. It pierces the terrace and forms small oblong lagoons. Around the lowest course of the brook the ground was perfectly barren, but a little higher up around the camp, there was even better grass than at *Camp XV*.

At 8.20 p. m. half a W. S. W. storm again began to sweep over the region, and the constant drumming of wind-driven sand against the tent proved that the solid material is brought from far away. From *Camp XVI*, Pan. 32A and 32B, Tab. 6, are taken showing a great perspectivic change in the general aspect of the southern range, and the rather uninteresting relief of the mountains bordering the lake basin to the north. Pan. 34 shows a small part of the southern range as seen from about the middle of the lake. The valley visible at about S. 25° W. is the same as the one below peak S. 42° E. on Pan. 31A.

*Camp XVI* was at about 5 m. above the surface of the lake. To the S. 15° E. the dark end of a terrace was visible on or near the southern shore of the lake. To this I steered my course, on *September 21st*, across the lake. From *Camp XV* the same dark terrace end had seemed to be situated at the eastern end of the lake. This is a very common mistake with these plateau lakes. Generally one estimates them too short, but sometimes the mirage makes them endless and they look rather like a bay from an ocean. At 11 a. m. it was 6.2° in the lake, a temperature which rose in the course of the warm and perfectly clear day. To the taste the water was, as I have said before, slightly brackish, but the areometer stood as in fresh water. The breadth of the lake proved here to be 7 km. Already at half an hour from the shore the depth was 35.1 m., and a quarter of an hour more, 49.0 m. At the next sounding, after another 15 minutes, the lead-line of 63.2 m. in length did not reach the bottom. My earlier experience in Tibet had proved, even in *Lake Panggong*, that 50 m. were quite sufficient. This lake proved to be an exception. At 1 o'clock in the middle of the lake the temperature of the water was 7°. Once every quarter of an hour a new sounding was taken, and at five such points in all no bottom was reached with the 63.2 m. lead-line. Half an hour from the northern shore the depth was 29.0 m. and a quarter of an hour from the shore



THE MOUNTAIN RANGE SOUTH OF LAKE EDITH FROM CAMP 15. (GEORGE PANOLAVA 31. A.)

L. A.



THE SAME RANGE FROM A POINT NEAR CAMP 16.





CAMP 15.







CAMP 15.





CAMP 15.





NORTHERN SHORE OF LAKE LIGHTEN.



10.0 m. The maximum depth of the lake, therefore, remains unknown, though, judging from a diagram of the soundings taken, the depth hardly can be more than 80 m. Still this lake proved to be the deepest of all I had sounded in Tibet. As a rule the Tibetan lakes are very shallow as could be expected from the general morphology of the plateau-land. But the relief of the surroundings of *Lake Lighten*, with high, steep mountains, especially at its southern side, is responsible for the comparatively great depth of this basin.

The distance across the lake had been measured every seven or eight minutes with an instrument for taking the velocity of currents constructed by Lyth, Stockholm. A steep terrace, at the most 5 m. high, followed the southern shore, but in front of it was a long, narrow lagoon separated from the lake by a pier of gravel, 1 m. high. This form of shore seemed to continue for miles towards the east. In the morning the lagoon at the northern shore had been covered with ice, 1 cm. thick. At the southern shore the water of the lake had a temperature of  $9.9^{\circ}$ . The freezing of the lakes, though at a very moderate rate, therefore may be said to set in about *September 20th*. At *Camp XV* we had had a belt of thin ice 2 m. broad along the western shore. This belt slowly increases in breadth and thickness towards the middle of the lake in the course of the autumn. But a lake of this depth will probably not be frozen all over before the middle or end of November, and perhaps still later.

From the point where we had landed, we steered E. N. E. and east with the intention of reaching the eastern shore where the caravan had orders to pitch *Camp XVII*. During this crossing of the lake we were attacked by a very severe western storm, which made all observations absolutely impossible. A few minutes before the strong wind began I got a new illustration of the transport of solid material by the wind. Above the transverse threshold in the west, yellow and light brownish clouds rose in the air to an altitude which seemed to be about  $30^{\circ}$ . These clouds of sand and dust were darker near the surface of the earth and became lighter the higher up they reached. After some minutes more the outlines of the mountains began to disappear, and finally vanished completely. There is no doubt, therefore, that these clouds of dust are carried away for great distances. Perhaps they are brought all over and beyond the lake. In the boat one could not notice any dust in the air. Only twice or thrice at the beginning of the storm I was able to take the velocity. The distance of 23 km. to the eastern shore may, therefore, only be considered an estimate. We were driven by wind and waves for nearly two hours. The flat belt of land along the northern shore, where Wellby and Malcolm had wandered 10 years earlier, seemed to run out in rounded necks of land inside of which lagoons were situated. The latter could only be seen when their piers were pierced by narrow channels. At the eastern shore there was a rounded terrace of

sand and clay. From the landing place we had to go 3.7 km. N. N. E. to *Camp XVII*. The caravan had in the meantime made a very long march along the northern shore, where M. A. Stein had gone. The men said they had rounded an irregular bay to the north. From *Camp XVII* a short panorama was taken the next morning. No. 33, Tab. 6. The peak here visible to the S.  $19^{\circ}$  W. is the same as the one visible to the S.  $69^{\circ}$  E. from *Camp XVI* (Pan. 32A). It had also been in sight during the whole trip eastwards.

During the next day's march, on *September 22nd*, we left the basin of *Lake Lighten* and entered the basin of *Yeshil-köl*. The transverse boundary threshold is here twice as far from the shore as in the west, but still comparatively near the lake. The march to *Camp XVIII* was 13.7 km. in length to the S. E. and E. S. E. From *Camp XVII*, which was situated very near the lake and about 5 m. above it, we had 12 km. to the threshold, giving a rise of 201 m. or as 1:60, as the height of the threshold is 5,301 m. From the threshold it is 1.7 km. down to *Camp XVIII*, which was at 5,168 m. or 133 m. below the threshold. The rate of the slope is, therefore, here as 1:13, which may be said to be unusually steep.

There is a belt of light greyish clay along the eastern shore, only a few meters above the surface of the lake and including the terrace which corresponded to similar formations at other parts of the shore. But here, in the east, where the shore is more particularly exposed to the prevailing winds, wind and water had modelled out a curious relief in the clay ground, reminding one of the so called *yardangs* in the desert of *Lop*. It was a labyrinth of cones, walls, tables, and between them, furrows in these layers deposited in the lake at a time when it stood a few meters higher than now. Amongst and even beyond this belt of clay there were a few small and narrow ribbons of black, rotten lacustrine plants. Such had also been seen under the present water surface near *Camp XVI*. They seem to indicate that the lake has been perfectly fresh not very long ago. If this has been the case at only a 5 or 6 m. higher level, the lake must have had a subterranean outlet to the west or east, more probably to *Lake Yeshil-köl*, which now is 150 m. below *Lake Lighten*. If the surface of the lake by its sinking reaches some impermeable strata, the outflow will be cut off and the water becomes brackish and salt. *Lake Lighten* seems to be in a state of development of this kind, though it may be that its vegetation to a certain extent still is alive. Inside the clay belt at *Camp XVII*, the ground was partly swampy, probably the remains of old lagoons.

Marching along the southern base of a small mountain range, we slowly ascend the valley coming from the eastern threshold. In its centre there is a brook receiving very small tributaries from both sides, but now not growing sufficiently large to be able to reach the lake. The bottom of the broad valley has a good deal of grass and yapkak plants. *Pantholops* antelopes were numerous, and dung of wild yak



abundant. We had seen two or three yaks above *Camp XVI*, being the first in this part of Tibet.

To the east a rounded hill rose between the low ranges north and south of the valley, and it seemed difficult to decide whether the next transverse saddle was north or south of it. We tried the southern side and soon reached the threshold at an elevation of 5,301 m. *Lake Lighten* now was hidden, but to the east we had a new considerable self-contained basin or isolated drainage area surrounded on all sides by moderate mountains. This basin appeared to be very flat. In its lowest part was *Yeshil-köl*, with very flat shores all around, except in the north, where the mountains reached near the lake. These flat shore plains especially to the south, were shining white with salt, and even at a distance, we got a strong impression that the lake was drying up. From the morphology of the basin it was easy to see that this lake must be shallow. To the east far beyond the lake a great mountain with eternal snow was seen, forming some flat cupolas. To the south were moderate violet mountains. Going down E. S. E. from the pass we had red, low, steep hills to our right. The rock is reddish brown conglomerate. To the left were low hills. In the middle of the descending valley was an erosion bed which lower down contained water from a tributary from the northern side. At *Camp XVIII* good grass, yapkak, and yak dung were abundant.

From this place we were only 10 km. from *Camp XIX* on the west shore of *Yeshil-köl*. The direction is east and E. S. E. *Camp XIX* lies at 4,955 m. or 213 m. below *Camp XVIII*; the fall of the ground is, therefore, as 1:47.

The ground is undulating due to small, flat mounds of grass; between them several small furrows go S. E. to the principal erosion bed from the threshold. To the S. S. E. beyond the violet mountains, there is a snow-covered range with high peaks. The lake is of a brilliant blue colour. From a distance it is easy to see the concentric desiccation lines at its southern side, where two or three isolated pools have the same bright colour as the lake. A little knoll at the side of our course consisted of black, dense basalt. To the right at some distance was a small isolated hill with well developed beach-lines at its N. E. base. Near the point where the chief erosion bed receives a tributary from the north the camp was pitched. The beds are comparatively energetically cut down in the ground between grass-grown mounds. At one place here living rock cropped out and consisted of reddish grey sandstone. The water was brackish, though drinkable. The camp was located about 1 km. from the shore and some 10 or 15 m. above the lake which has an elevation of 4,945 m. Several beach-lines are crossed between the camp and the lake. The water of the latter is very salt but perfectly clear. The 1 m. line ran at about 100 m. from shore; at 600 m. from shore the depth was 4.6 m. At 5 o'clock p. m. the lake had a temperature of 8.2°.

*Yeshil-köl* or the Green Lake as it is called by the Mohammedan Taghliks in the *Kwen-lun*, was previous to my journey, well known to students of the geography of Tibet. Carey had already passed along its western shore in 1886, and the same way was taken in 1892 by Dutreuil de Rhins and Grenard. On his memorable journey, 1896—1899, Deasy had passed along the northern, eastern and part of the southern shore, and along the northern shore Wellby and Malcolm had travelled in 1896. Finally Zugmayer passed on the plain immediately west of *Yeshil-köl* in 1906. Under such conditions I had not very much to add except measuring the depth of the lake. Neither is the lake unknown to the Changpas or northern Tibetan nomads, as could be seen from the small earthen cairns or mounds, which they are erecting in long straight lines for hunting antelopes. Now the region was as lifeless as the rest of Northern Tibet.

The crossing of the lake was accomplished on *September 24th*, 5.9 km. E. N. E. to the northern shore, and thence 8.2 km. S. E. to the southern shore. The situation will be well understood both from the photographic panorama on the opposite side, and from the sketched panorama, 35<sup>A</sup> and 35<sup>B</sup>, Tab. 7, taken from *Camp XIX*. On the latter we see the mountains to the N. W., north and N. E., where the lake comes to an end in this direction. N. 68° E. a red hill served as a landmark, and on this our course was steered. From there we should try to steer upon a point to the S. 71° E. on the southern shore, where a bright point was said to be the place where springs come up and where Deasy had passed several days, as two of my men could witness who had accompanied him. To the S. 40° E. the southern end of the lake appeared. From S. 15° E. to south stretched the high snow-covered range mentioned above. When seen from a short distance, the water of *Yeshil-köl* has a green colour, which is partly due to its comparative shallowness. The bottom consists of grey clay, of salt crusts hard as stone, of sand with ripplemarks, and, at the northern shore, of gravel and blocks as the continuation of the mountains rising there. At the western shore the clay forms, as it were, a barrier of blocks incrustated with salt; they are to be seen both below and above the water. At 1 o'clock p. m. the water had a temperature of 9.5° and the air 10.3°. On the first crossing, which took us 4½ hours, the greatest depth sounded was 16.10 m. and was situated nearer the northern than the southern shore. This depth remained the absolute maximum I measured in this lake, and it is not likely that deeper places would be found, at least not south of our course, for the southern half of the lake is very shallow, being a gradual continuation of the nearly level plain south of the lake. At a very short distance from the northern shore there are ridges of hills more or less parallel with the shore-line, and at one place with a steep fall to the lake. From the landing point the shore-line runs N. 70° W., after which it gradually turns west, S. W. and south, and on the other hand, to S. 80° E., S. E., south and S. W. Just where we

landed there was a curious series of blocks, lying on a bank of gravel and directed to the S.  $42^{\circ}$  E., being partly above the present water level. At 3 o'clock p. m. the water had a temperature of  $11.1^{\circ}$ . No sign of life was seen in the lake. The shore was absolutely barren, and partly white with salt. Several terraces are seen, proving a rather rapid rate of desiccation. Only the slopes of some hills were yellow with sparse grass.

The second line across the lake to the S. E. gave the soundings 10, 11, 10, 8 and 6 m., and a few minutes afterwards only half a meter. The southern shore proved to consist of salt crusts, with small lagoons and channels between comparatively dry patches, the whole being more like a salt swamp stretching about 1 km. inland. At many points the water bubbled, probably from springs. In this salt swamp the night was passed, at *Camp XX*. Next morning we were only 2.6 km. from *Camp XXI*, Deasy's springs, where the caravan had arrived in the meantime. They had had a very difficult task in rounding the southern side of the lake. Here a comparatively large brook had to be crossed, and the ground at its sides was so soft, that the animals sank deep into it. After much searching they had found a place, where the loads could be carried over by men, and the ponies and mules brought over. This report seems to agree with the fact that no European traveller has followed the southern shore. The brook is probably the same which, coming from the W. S. W., has been surveyed by Carey, de Rhins and Zugmayer, which, on their maps, is called *Tang-marbo* and *Yeshil-su*. Nearly the whole of its course seems to be swampy, and it does not flow into the lake itself, but into the salt swamps at its S. W. side. Farther east there is another brook coming from the S. W. from the mountains N. E. of *Arport-tso* and surveyed by Deasy. It reaches the salt swamp somewhere west of *Camp XX*.

A little knoll of solid rock near *Camp XXI* consisted of dark grey fine-grained or dense limestone. On the slopes of a mountain standing S. S. E. of the camp sharply drawn old beach-lines could be traced at a height of some 70 m. above the present lake, which, therefore, must have been at least three or four times more extended than now. These beach-lines will be seen on the hills to the S.  $35^{\circ}$  E. and S.  $15^{\circ}$  E., Pan. 36A and 36B, Tab. 7. On the same panorama it will be seen that the mountains south and S. S. W. of *Camp XXI* are receding at a considerable distance from the lake, a gradually sloping plain extending between them. To the N. W., north and N. N. E. are seen the mountains north of the lake, some of them, particularly to the north and N. N. E., being rather high and covered with eternal snow.

On *September 26th* the march is 16.2 km. E. S. E. and N. E. to *Camp XXII* where the absolute height is 5,040 m. or 85 m. above *Camp XXI*. The ascent is, therefore, very gradual or as 1:191. To the north of our course is a salt pool

surrounded with white salt incrustations and with beautiful rings of old beach-lines resembling the amphitheatrically arranged benches of a circus. We move on one of the higher »benches» at 40 or 50 m. above the pool. The whole ground is here white as the snow on the *Kwen-lun* group visible above it at the horizon in the N. N. E. Immediately to our right is a brownish violet low ridge. Fresh springs are passed at several places. The grass is scant, but antelopes are seen. Of other animals there are only wolves and ravens. Not far from the pool the rock was grey, fine-grained quartzitic sandstone. At the base of the beach-line we follow, some springs again appear, surrounded with grass and moss; their water goes to the salt pool, which is a cut off part of *Yeshil-köl*. A pier-like ramification from the hill at *Camp XXI* separates them. On the northern side of the pier sharply marked white desiccation lines are seen concentric with the present shore-line. From the eastern rim of the salt pool depression the two most dominating groups of the *Kwen-lun* are seen to the N.  $31^{\circ}$  W. and N.  $1^{\circ}$  E., corresponding to those visible N.  $21^{\circ}$  W. and N.  $13^{\circ}$  E. on Pan. 36B.

Two other very small depressions are passed, and a watercourse with a comparatively deep-cut bed. The ground is undulating and covered with good grass. The rock is grey oolitic limestone. At *Camp XXII* stood grey, dense unclean limestone. This camp is in the same place where Deasy had dug down his depot in the ground, and which, in 1903, was visited by Rawling. The depot had also been examined by Tibetan hunters.

The march of *September 27th* goes nearly east for 15.2 km. In the first 10.5 km. the ground rises 55 m. to a little threshold 5,095 m. high, or at a rate of 1:191. In the last 4.7 km. the ground again falls 18 m. or at a rate of 1:261. The threshold, which may be regarded as a transverse pass in the eastern continuation of the great latitudinal valley, is, therefore, very insignificant. Still it is the boundary between the basin of *Yeshil-köl* and that of *Pool-tso* (or *Pul-tso*), and has, therefore, a certain importance as a waterparting.

*Camp XXII* was situated amongst very low soft sandhills, which continue for a while to the east, after which we come out on a wider undulating valley plain with abundant grass, and pierced by several erosion furrows, some of them with brackish water. The ground is soft and red, sand and dust. No wild animals, but dung of yak and kyang was seen. To the E. S. E. the mighty cupola-shaped mountain mass is seen, which Rawling called *Deasy Group*. Our way goes up and down over very low hills or rather unevennesses of the ground. Finally the threshold is reached, and it proved to be extremely flat. The rock was dark grey, dense limestone. Nearly the whole southern half of the horizon is hidden by a limestone rock. The northern half being open, Pan. 39, Tab. 7 was sketched showing some of the mighty *Kwen-lun* Peaks to the north and N. N. W.



CAMP 22 WITH THE DEPOT OF CAPTAIN DEASY.



The threshold proved to be double or rather to form a platform with a very shallow depression in its middle. The bottom of the latter consisted of red clay cracked up in innumerable polygons, but obviously containing some water after rain. At the eastern margin of this depression we reach the end of the threshold, and now the view is free over the next lake, the one which Rawling calls *Pool-tso*, though I do not know why, nor in what language. The salt incrustations were called »*pool*» by my men, but this lake was as nearly fresh as possible and its water perfectly drinkable, though it has no visible outlet. Deasy, Wellby and Rawling had visited the lake, but they had found no opportunity of surveying its outlines. Already from the little threshold above *Camp XXIII* the lake proved to be oblong from north to south which is rather rare, as most Tibetan lakes are oblong from east to west, which is also the prevailing direction of the mountain ranges.

At *Camp XXIII* there was a 5 or 6 m. high beach or shore terrace, between which and the water the shore was covered with the remains of rotten lacustrine weeds, lying as a carpet on the sand. The grass was good in the neighbourhood and there were heaps of yak dung. The first wild yak was shot beyond the hills to the south.

The Pan. 37<sup>A</sup> and 37<sup>B</sup>, Tab. 7, taken from *Camp XXIII*, embraces only the eastern half of the horizon, that is to say the whole northern half of the lake and its surrounding mountains. To the N. 1° E., where the limestone cliffs just north of the camp fall steeply down to the western shore, the shore-line continues to the northern end of the lake, and in the same direction, at a distance of perhaps 4 or 5 days' march, one sees the contour-line of one of the main *Kwen-lun* Ranges. To the N. E. are moderate hills, strongly denudated and rounded as usual. To the N. 56° E. are the steep hills which seemed to fall directly down to the edge of the water and upon which we steered the boat the next day. To the E. N. E., there was a low silhouette of distant mountains. From east to S. 69° E. rose the mighty group of Deasy's name with uninterrupted snow-fields on its head. To the S. E. were the mountains bordering the lake on the east. The colour of the water was as pure blue as that of *Lake Lighten*, both of these lakes being more blue than *Yeshil-köl*, which indeed had a tint of green in its colour.

In the evening and the whole night a furious storm from the east swept over the desolate land, and the waves were in energetic action, eroding the present shore line. The next morning, when the storm had ceased, there was a good deal of fine dust in the air, so much at any rate that *Deasy's Group* had vanished. The transport of solid material by the wind could, therefore, be well observed.

On *September 28th* we crossed this lake, which is at a height of 5,077 m., or 18 m. below *Lake Lighten*, and 132 m. above *Yeshil-köl*. The first sounding line was only 2.4 km. to the N. 56° E., the second 5.4 km. to the S. S. E. On the first

line which took a little more than an hour, the maximum depths of 16.88 and 16.53 m. were sounded about halfway, and on the second line the depth diminished in the direction of our course: 15.15, 15.01, 13.60, 12.55, etc., the greatest depth being not far from the northern shore, where the mountains were steep. At 1 o'clock p. m. we had a temperature of 6.7° in the lake and of 3.5° in the air.

Steering S. 24° E. we finally reached what we supposed to be the southern shore of the lake, and there the night was passed. By nearer examination it proved, however, to be only a long narrow peninsula from the western shore, pointing straight to the east, and dividing the lake into two basins, the southern a little smaller than the northern. On the shore ducks were seen, as previously on *Lake Lighten*. The beach was of the same kind as at *Camp XXIII*, a wall rather than a terrace.

On *September 29th* the southern basin was examined. The course now was 3 km. S. S. W., 3 km. S. 87° W., 4.5 km. N. 55° E. and 4.7 km. nearly north.<sup>1</sup> On the second of these lines the greatest depth was 13.65 m. At the western shore there are four very regularly built terraces, each about 2 m. high. From the slope above them, Pan. 40, Tab. 7, was taken, giving an idea of the hills surrounding the southern part of the lake. To the N. 55° E. the narrow sound is visible joining the two basins. Wild yaks were seen to the S. E. On the third line, to N. 55° E., back to the sound, the greatest depth was 19.0 m. which proved to be the maximum depth of the whole lake. At 1 o'clock p. m. the temperature was 6.3° in the water and 1.9° in the air. The sound is about 60 m. broad, and the comparatively great depth of several meters in its middle may depend upon currents caused by different winds. With a strong S. W. wind the water will be driven from the southern to the northern basin, and with a N. W. wind from the northern to the southern. Thus the fine deposits in the sound are continually washed away. On the course to *Camp XXV* we kept near the eastern shore where the depth nowhere exceeded 3 m. On the way the delta of a brook is passed. This brook comes from the E. N. E. and reaches the lake in a rather broad channel, surrounded with flat banks of silt and sand. *Camp XXV* was pitched in the N. E. corner of the lake. At 6¾ o'clock p. m. the usual storm came from E. N. E., a direction which during several days had been prevailing in the evening and most of the night.

On *September 30th* our march goes E. N. E. in a nearly straight line for 16.2 km. to *Camp XXVI*. Near this camp the boundary threshold of the basin of *Pool-tso* is crossed at a height of 5,239 m. The height of *Camp XXV* is at 5,083 m., or 6 m. above the surface of the lake. From *Camp XXV* to the threshold, a distance of 14.8 km., the ground, therefore, rises 156 m., or as 1:95. From the threshold to *Camp XXVI* is 1.4 km. or a fall of 98 m., as the camp is at 5,141 m.; the rate is here as 1:14.

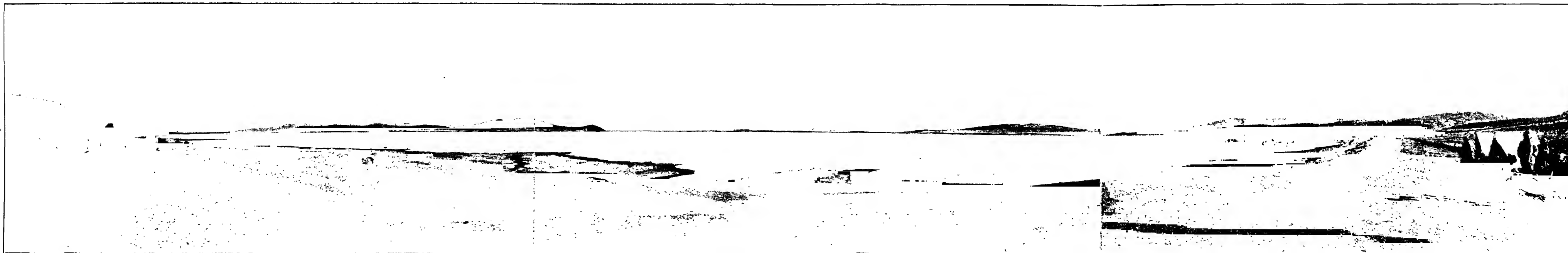
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<sup>1</sup> On Pl. 2. the red lines have to cross each other in the sound.





CAMP 0, LOOKING N 29° W 10° S 58° E. IN THE BACKGROUND LAKE AKSAI-CHIN (CP. PANORAMA 24, A.)



POOL-TSO, LOOKING NORTH TO S 15° E, FROM CAMP 23 (CP. PANORAMA 37, A.)



From *Camp XXV* our route rises slowly in a broad, open valley, the floor of which is sand, dust and fine gravel, with a little patch of grass and yapkak here and there, but generally barren. No watercourse is crossed, but the whole ground seems to have been washed by occasional rain-water. To the right of our route there is, however, the chief watercourse of the valley, beginning from the little threshold and the bright red mountains north of it. The hills to the south, standing 2 or 3 km. from our route, are of a dirty brown colour. The living rock on the pass is reddish brown fine-grained sandstone and conglomerate.

From the little threshold the view was unlimited to the N. E., *i. e.* so far as the not quite clear air permitted. No mountains were visible in this direction, only the continuation to the E. N. E. and N. E. of the enormous latitudinal valley we had followed ever since *Aksai-chin*, and which Wellby had followed eastwards all the way through Tibet. The part in front of us is the same which Rawling has called *Antelope Plain*, a name that is inappropriate as there are antelopes in nearly all the plains of Tibet. To the N.  $66^{\circ}$  E. and N.  $83^{\circ}$  E. a low ridge of mountains was seen (Pan. 41, Tab. 7). Some six kilometers east of the pass the next lake was to be seen, smaller than the previous one. The ground in this region is of an intensely red colour. From the mountains to the north several very insignificant brooks come down, all of them now frozen. At the first, which contained some open water, *Camp XXVI* was pitched in a comparatively protected valley with good grazing and fuel. At all the four transverse thresholds we so far had crossed in the latitudinal valley the same observation had been made, *viz.*, that the eastern slope is steeper than the western and, as a rule, the lowest part of each depression, or in other words the lake, was situated nearer to the western boundary threshold than to the eastern.

A little east of the pass the rock was grey limestone. The gravel around *Camp XXVI* consisted mostly of grey oolitic limestone. From the camp the highest peak of the *Deasy Group* was visible to the S.  $40^{\circ}$  E., and the nearest peak to the S.  $51^{\circ}$  E.

On *October 1st* the march to *Camp XXVII* was only 9.5 km., and the new camp, being at 5,081 m., was 60 m. below the previous one, giving a slope of 1:158. The direction is E. N. E. The little brook at which we had camped turns E. S. E. towards the next lake.

The lake, which is marked on Rawling's map, has a height of 5,078 m. Its colour is green and its water as fresh as any spring water. From a valley in the *Deasy Group* to the S. E., a rivulet enters the lake; it still carried water, and must be quite large during the summer. The lake must have an outlet somewhere, perhaps subterranean. About one quarter of its area was frozen, but now gradually became broken up by the very strong eastern wind. Only along the windward or eastern shore the ice formed needles and jags pointing towards the wind. Along

the northern and western shore, a little above the water, there was a wall of white porous ice-fragments driven up by the winds and waves. The water along the shore had a temperature of  $-0.2^{\circ}$ , and as soon as the atmosphere became quiet the whole lake would no doubt be frozen all over. The early date of freezing, and the morphology of the basin, which is extremely flat and with a comparatively great distance to the nearest mountains, indicate that the lake must be shallow. From the north a very shallow and broad watercourse goes to the lake. It is rather an alluvial belt with many beds separated from each other by patches of sand with good grass. When great quantities of water occasionally wash down through these beds the latter form islands. Only in one of the beds there was now some water. We camped at the left side of this watercourse. The place was very favourable as grass, fuel and water were plentiful. Just N. E. of the camp there was a large fresh-water pool. Near the lake three old tent poles were found, probably left behind by Wellby or Rawling. A strong eastern wind, nearly a storm, had now been blowing some 45 hours without interruption. This wind seemed to be characteristic for the season and for this part of the country. It makes the journey very hard and difficult, hampers all work outside the tent and kills the caravan animals. The length of the marches is always dependent upon the presence of grass, water and fuel, as everything must be done to save the caravan.

The Panoramas 42, Tab. 7, and 43, Tab. 8, are sketched from points at a long distance from each other. Both are intended to give an idea of the *Deasy Group* as seen from *Camp XXVII* and at a point 3 km. W. S. W. of it.

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## CHAPTER V.

### IN THE LATITUDINAL VALLEY SOUTH OF THE KWEN-LUN.

On *October 2nd* the march continues in a straight line E. N. E. for 16.7 km. The ground rises imperceptibly or only 56 m., as *Camp XXVIII* is at a height of 5,137 m.; the rate is, therefore, as 1:298 or perfectly level to the eye. It is, therefore, difficult to tell in which direction the several extremely shallow waterless erosion furrows are directed which are crossed by the route. Sometimes one got the impression that they went diagonally across the plain to the N. W., but that is uncertain. Everywhere there is grass and yapkak, a real highland steppe. The landscape is extremely monotonous as is usually the case in latitudinal valleys. The single points of interest are the snow-groups to the north and south, though they had been in sight for several days, the *Deasy Group* all the way since the threshold west of *Yeshil-köl*. Near *Camp XXVIII* there were two fresh-water pools. In such regions as these, hard rock is, of course, not within reach. From *Camp XXVIII* a complete panorama, 44<sup>A</sup> and 44<sup>B</sup>, Tab. 8, was made all around the horizon. To the S. 20° E. and S. 3° W. the culminating peaks of the *Deasy Group* are seen. To the S. W. and W. S. W. from where we come, no mountains are visible chiefly due to the unevenness of the ground. To the S. 82° W., west, N. 81° W. and N. 70° W. only the highest summits of different mountains are visible. Then follows a gap to the N. W., and to the N. N. W. is the northern snow-covered group. To the N. E. is a protuberance of the soil hiding the mountains behind. To the E. S. E. and S. E. are moderate hills bounding the latitudinal valley to the south.

On *October 3rd* the route is towards the N. E. and N. N. E. for 15.8 km. *Camp XXIX* has a height of 5,091 m., so the ground sinks 46 m. or as 1:343. In comparison with *Camps XXVII* and *XXIX*, *Camp XXVIII* was, therefore, highest being situated at the base of the cupola-shaped but flat protuberance in the middle of the latitudinal valley. The wind was again from the west and the minimum temperature for the night was —22.0°, which may be regarded as sharp for the season.<sup>1</sup>

<sup>1</sup> All the temperatures and other meteorological observations are to be found in Volume VI, corrected and controlled by Prof. Nils Ekholm.

During the march no water was seen. It would have been absolutely impossible to tell in what direction this plain sloped. It seemed perfectly level except for small undulations of the ground. One had, however, the feeling that a large watercourse existed somewhere to the right and directed to the N. E. Living rock was passed only once on a little knoll of greyish white, dense limestone. The ground is also of soft material, sand, fine gravel and dust. The northern snowy group is comparatively near, and belongs to the mountains bounding the latitudinal valley to the north. Its slopes, therefore, seem to go directly down to the great plain of the latter. To the left of our route there is a series of very low and flat hills which probably may be regarded as the last ramifications of the snow group. From these hills many watercourses come down. None of them contain water, but a few are still moist, and they seem to carry a considerable amount of water in summer. All of them turn eastwards to the main watercourse, situated to our right and not clearly visible. The grass vegetation comes to an end, but sparse yapkaks are still seen. Finally all kind of vegetation ceases and the ground is absolutely barren. On the northern side of the great valley, *Camp XXIX* was pitched at the left side of a main watercourse which had a 1 m. high erosion terrace at the left side and contained some not quite fresh water.

Pan. 45A and 45B, Tab. 8, taken from *Camp XXIX*, shows the appearance of the highlands and mountains all around the horizon. To the S. E. and S. S. E. there are ranges of medium height, and to the S.  $12^{\circ}$  W. we see the whole *Deasy Group* at a distance of about 36 km. To the N.  $55^{\circ}$  W. is the highest peak of the northern snow-group which now is very easily visible. Towards the east the ground slopes from north to south.

On *October 4th* the direction is E. N. E. for 13.7 km. and the floor of the valley here slopes downwards 67 m., for *Camp XXX* is at a height of 5,024 m., which is as 1:204. The differences of height are here, disregarding the mountains, so small, that the surface of the plateau-land may be said to be practically level. The country remains as monotonous as ever. The snow-groups north and south of the valley are left behind more and more — this is the only variation. The rest of the distant panorama is hidden by low hills of detritus. Even gravel is rare, the material constituting the floor of the valley is extremely comminuted and appears to be in a very advanced form of division. It seems as if even the agencies of denudation and weathering had very little left to do in these regions.

We follow the watercourse which passes the camp, towards the east. It contains some pools and, for a short distance, even some running water which proves that the ground falls to the east, a fact that could not otherwise be settled except by means of instruments. The main brook of the valley which hitherto had only been suspected of flowing north eastwards, now came in sight and remained in

our sight during the day's march. From the hills to the right several dry watercourses go down to the main brook. The grass is abundant and gives the whole bottom of the valley a bright yellow appearance. *Camp XXX* was pitched on the right erosion terrace of the main brook. The terrace was a little more than 1 m. high. At its base in the bed four springs came up, three of them frozen, the fourth forming a partly frozen pool of excellent water. The camp could be said to be unusually favourable for being in the north of Tibet. On both sides are very low rounded hills of detritus hiding a distant view all around. A panorama drawn from such a place would only have represented a waving line without interest.

On *October 5th* our direction continues E. N. E. to *Camp XXXI*, where the height is 4,939 m. The distance is 14.3 km. and the fall 85 m. or as 1:168. Somewhere in the vicinity of *Camp XXVIII* we had passed the flat threshold between the last lake and the basin in which we now were moving for three days. As before it would have been impossible to judge with the naked eye in what direction the valley sloped. Sometimes, by an optical illusion, it even seemed to rise to the east.

Leaving the camp we stick for half an hour to the bottom of the watercourse where the ground is hard and level as a street. The bed is very broad, and it took nearly a quarter of an hour to cross it. It is here not sharply bounded. In the bed there are several patches of grass, like islands, among sand and gravel. The bed is moist at some places. The subsoil water is very near. A little pool contained fresh water.

There is no more grass in the middle of the valley, but only the hard, dry plants called *yer-baghri* and *yapkak*. But at the base of the hills at both sides the ground is yellow with grass. These hills are very insignificant, but high enough to conceal the more distant landscape. Everything, therefore, seems extremely flat, especially as the higher mountains often are hidden by clouds. Farther on, however, the northern snow-group again comes in sight. It is a mighty black range covered with snow-fields and small glaciers. The main watercourse now remains on our left for a long while. Where we reach it again, some pools of fresh water stood in the bed, one of them even 50 m. long and 2 m. broad. Later on, at *Camp XXXI*, fresh water was obtained by digging in the bed, the bottom of which was here only 70 cm. below the general level of the ground. Here the temperature at the surface of the bed was  $+0.1^{\circ}$ , 20 cm. deep  $+0.2^{\circ}$  and 46 cm. deep  $4^{\circ}$ , where the surface of the subsoil water stood.

Seeing that the snowy range to the north very soon would become hidden by the flat undulations of the ground and by small hills, I made a panoramic sketch of it from a point 2 km. S.  $70^{\circ}$  W. from *Camp XXXI*, Pan. 48, Tab. 8. To the N.  $86^{\circ}$  W., N.  $57^{\circ}$  W. and N.  $47^{\circ}$  W. very considerable peaks of this range were

visible. It is certainly one of the most important ranges of the *Kwen-lun* System, and it has, in this region, been surveyed chiefly by M. A. Stein. On the other or northern side of it, *Keriya-daria* and *Yurung-kash* have their sources. The N. E., E. N. E. and eastern continuation of this range is unknown.

The only explorers who had visited the region where I now was moving were Wellby and Malcolm in 1896 and Rawling in 1903. To avoid their itineraries, I kept 14 or 15 km. N. W. of them. Fifteen kilometers south of my *Camp XXXI*, was the point where the routes of Wellby and Rawling separated. From there Wellby continued N. E. and E. N. E. while Rawling turned eastward to his *Lake Markham*, which the whole time lay out of sight from my route.

On *October 6th* the march goes N. E. and E. N. E. for 14.6 km. and the downward slope of the valley is here 62 m., as *Camp XXXII* is at a height of 4,877 m., the rate is thus as 1:235. Our route follows the main valley which here is only some 400 m. broad and bounded by low rounded hills. This valley is a perfect Eldorado for northern Tibet. The ground, consisting of sand and fine sparse gravel, is everywhere covered with excellent grass, better than anywhere ever since *Muglib*; there is an abundance of fuel in the form of the ordinary low, highland plants with hard, wooden stems. There is water everywhere, sometimes running in the bed of the main brook, sometimes forming pools covered with ice 3 cm. thick. From both sides, more especially from the northern, small tributary brooks come down, most of them now frozen or forming extended thin ice-sheets. Where these brooks are formed of springs their ice-sheets would continue to grow bigger in the course of the winter. At several places in the valley flocks of antelopes were seen. The principal bed in the middle of the valley is meandering in soft rounded bends from one side to the other between erosion terraces 1 or 2 m. high. Farther on, two more tributaries entered from the left side. Their brooks were open, but became changed into ice as soon as they reached the bed of the main brook.

A little beyond halfway, the narrow valley comes to an end, and the brook flows out in a plain, which, at several kilometers distance north and south is bounded by hills of moderate size. One has the feeling that beyond those to the north and N. W. there must be a latitudinal valley which is again bounded on the north by the chief range with the snow-fields which we had seen a few days earlier. If such a latitudinal valley exists it must be parallel to the one followed by Wellby, and may perhaps be the western continuation of the one I followed in 1896. This question has to be settled by future exploration.

Some broad and shallow erosion beds without water and ice were crossed before we reached *Camp XXXII* at the left side of the main brook, where grass and fuel was plentiful, and a pool of ice-covered water stood at the base of the left erosion terrace. The wind that began to blow in the afternoon was of a cyclonic



character, beginning from N. 60° W. and in the course of half an hour turning over north and N. E. to E. N. E., after which it diminished in force.

On *October 7th* we proceeded 12.3 km. between N. E. and E. N. E. to *Camp XXXIII*, where the height is 4,923 m. or 46 m. above the previous camp, meaning a gentle rise of the ground, as 1:267. We are still following the enormous latitudinal valley to the E. N. E. and the landscape remains extremely monotonous. From *Camp XXVII* the *Deasy Group* was visible to the S. 44° W., and the principal peaks of the snowy *Kwen-lun* Range to the S. 88° W., N. 63° W., N. 31° W. — between these two there may well be a latitudinal valley — and N. 13° W.

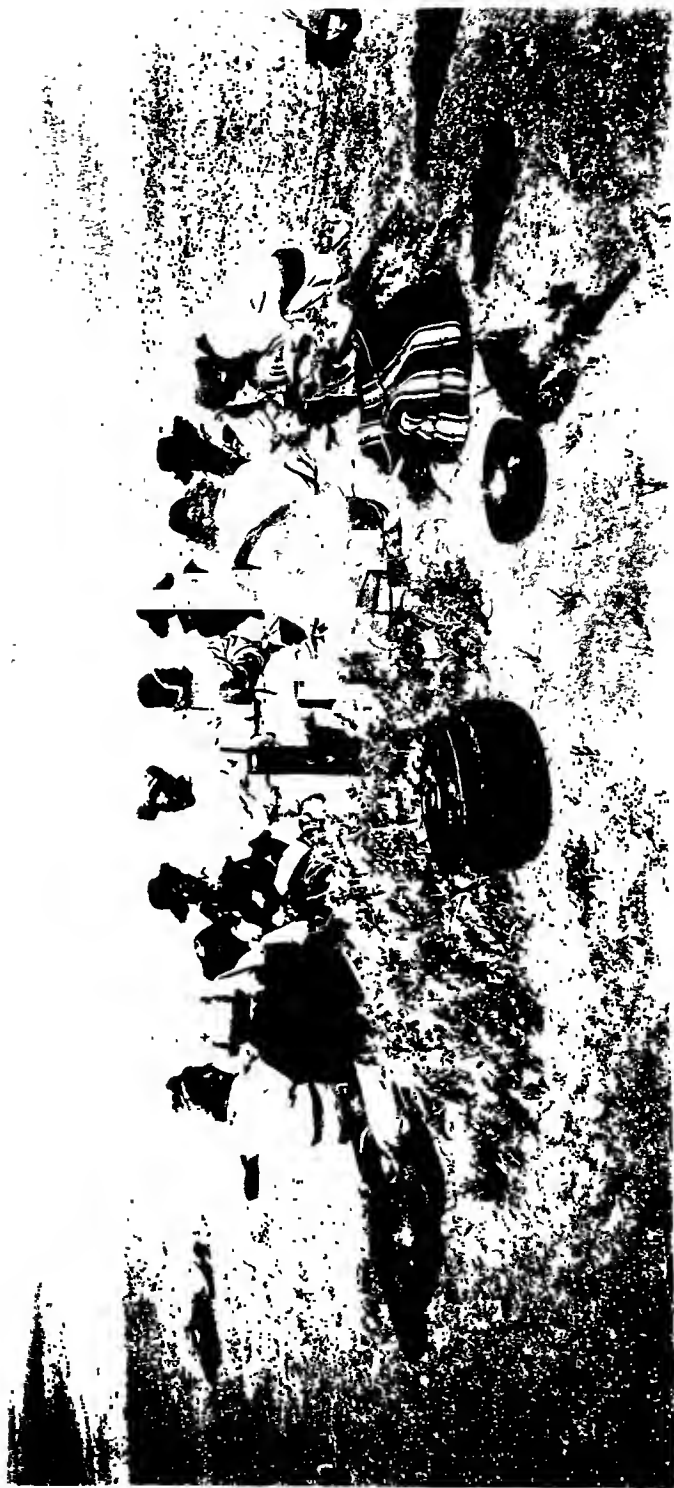
Starting from *Camp XXXII*, we leave the main brook behind to our left, where it makes a bend to the north and N. E., and empties into the salt marshes of the western shore of the next lake. The lake is, however, not yet in sight. It is hidden by a ridge of low hills situated on its southern shore. Following the southern base of these hills, we cross a series of small erosion furrows all bound for a very long and narrow depression, the bottom of which is covered with a sheet of perfectly level yellow clay that has been brought down in the form of silt by the temporary watercourses around. Slowly ascending the hills, we get a beautiful view of the whole lake. Continuing on the top of the hills we find a spring of fresh water. At *Camp XXXIII* the grass is as good as before. This part of Tibet had indeed proved to be much more favourable than I had suspected. The only difficulties are the continual hard winds, and the early cold, which last night had been down to  $-24.8^{\circ}$ .

From a point 2.5 km. S. 69° W. from *Camp XXXIII*, Pan. 46, Tab. 8, was made of the horizon from S. W. over north to N. E., the other half being hidden by near, undulating, low hills. To the S. 45° W. the highest point of the *Deasy Group* is still visible in a very fine, distant perspective. From S. 84° W. to N. 50° W. we have a brilliant view of the snowy *Kwen-lun* Range which now for so many days had been in sight, and soon would disappear altogether. We had never before had such a continuous view over the whole dark range with its white snow-fields and small glaciers. To the north and N. E. no high mountains or peaks could be seen. From the plain S. W. of the lake a long narrow neck of land goes out dividing this part of the lake into two bays. To a great extent, nearest the shore, the plain is white clay dust and salt, which is whirled up in clouds by the strong N. W. wind. A good deal of the S. W. part of the lake was now frozen over, but the ice was still so thin that it became broken up by the wind and drifted over the lake. The water is salt though not of a very high percentage. On the northern shore, there are low barren hills; on the southern, our ridge of hills falls rather directly into the shore, though here also are some patches or stripes of flat land with a few points of white silt or clay. We were about 60 m. above the lake, the absolute

height of which is about 4,863 m. It is, therefore, at a more than 200 m. lower level than *Pool-tso*, and the lowest lake we had passed so far. For five days we had followed the brook that finally emerges at its S. W. shore. This part of the great latitudinal valley resembled, therefore, in a very high degree the part of it that sloped to Lake *Aksai-chin*, though this eastern part generally was at a somewhat lower level. In both cases the fall of the valley is, as we have seen, extremely gradual, and in both cases there is a brook that gets most of its water from the *Kwen-lun*, or northern side, where the mountains are higher and the amount of snow greater. We had found the western brook still carrying water, but the eastern one was cut off, dry and dead as we passed it later in the season. In both, deposition of material supercedes erosion, and in fact these rivulets are both in a state of exhaustion and dying. But still, in the summer they may bring down considerable quantities of water, when the snows on the southern side of the *Kwen-lun* are melting or when heavy rains are falling.

On *October 8th* our direction is E. N. E. for 15.5 km. including a gentle rise of 73 m., or as 1:212. *Camp XXXIV* is at a height of 4,996 m. This rise is, however, not regular and gradual, for from the lake hills we first go down and pass a place of only 4,912 m. But still the undulations of the ground are very insignificant. The whole day's march we move over very low and flat hills of sand and gravel partly covered with vegetation. From *Camp XXXIII* we go downhill and lose sight of the lake. The living rock is greyish green calcareous sandstone the whole way, forming very low ridges cropping up out of the ground. As the dip is 42° S. 28° E. we march long stretches between such ridges one or two feet high. The rocks are extremely weathered and only these insignificant ruins remain of them. All the rest is covered by débris. At some places quartzitic veins are visible in the sandstone. The ground is covered with sand and fine gravel of sandstone and quartzite. Some slopes are quite yellow with grass; yapkak is seen everywhere. Antelopes are common; occasionally a yak is seen. Sometimes erosion furrows are crossed and it is not always easy to tell whether they go to the lake or to the other side. One of the eroded sides consisted to a large extent of solid sandstone. From this the ground rises to a little flat threshold, from the height of which the lake was again visible, and beyond it, to the west, the high snow summits of the *Kwen-lun* Range (Pan. 47, Tab. 8).

Farther on, the highest parts of the small hills we cross are to the north of our route, and the dry watercourses we are crossing go south, probably to some little isolated depression. To the north no dominating peaks are visible, to the south is a moderate red range, and beyond it a short range covered with snow. Between our route and the red range is a barren latitudinal valley which may rather be regarded as a part of the great one we have followed. No water was seen, and







ANOTHER VIEW FROM CAMP 35.

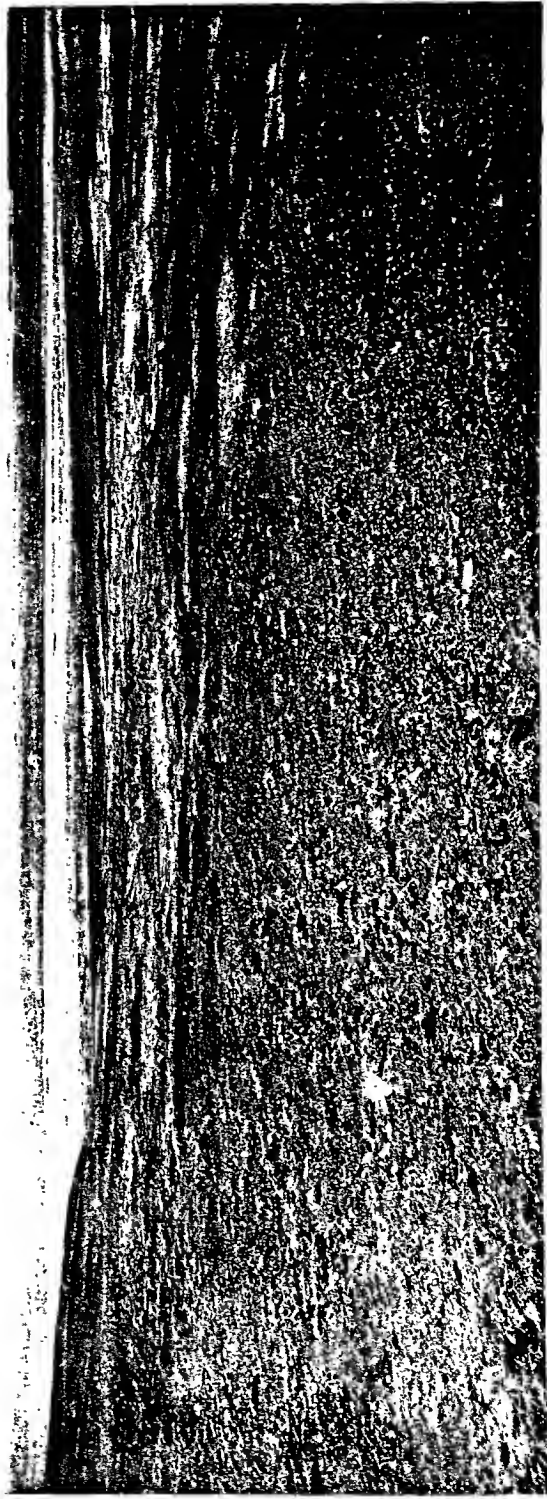




LOOKING S 30 E FROM CAMP 35.







LOOKING N 30° W FROM CAMP 35.



the water question is always important in this part of Tibet at the season when all watercourses are dry. In one bed between grassy hills water could be obtained by digging, but it proved to be salt. The ground is now rising gradually, and finally on a slope with very good grass, a fresh spring was found. This is *Camp XXXIV*.

We now had reached the point where we could turn S. E. and continue in that direction for a long way without touching explored ground. To continue to the E. N. E. would have been comparatively useless as Wellby and Malcolm have crossed this part of Tibet. Turning S. E., I would leave behind the regions so carefully explored by Deasy and Rawling to the west and S. W.

On *October 10th* we, therefore, turned E. S. E. and made 10.5 km. to *Camp XXXV*, where the absolute height is 5,033 m., or 37 m. above the previous camp, being an average rise of 1:284. The differences in height are, as we see, extremely insignificant, and in these parts of Tibet we may indeed speak of a typical plateau-land where the destructive agencies of denudation have accomplished their work most thoroughly.

The little brook from the spring at *Camp XXXIV* formed ice-sheets in its bed, which became considerably larger after a night of  $-23^{\circ}$ . These ice-sheets of perennial springs increase during the whole winter. The water in this way becomes stored. In spring or early summer when the temperature has become sufficiently high the whole ice-sheet begins to melt gradually and the little brooks have a period of maximum volume.

The day's march is as monotonous as ever. We go downwards among flat, soft hills sometimes with low ridges of solid rock. After one and a quarter hours, we reach the lowest part, which may be some 40 m. below the camp. Here we are again in contact with the level ground of the great latitudinal valley which we, however, soon again abandon, when we go up along a shallow depression between low hills. Here the rock is light reddish calcareous schist. The depression or little valley leads to a kind of open arena or trough to which several dry watercourses gather from the surrounding hills. There is grass and yapkak. From some places here the high peaks of the *Kwen-lun* were seen for a moment. A spring was found not far from *Camp XXXV* which was situated among rounded monotonous hills.

It is a general and very natural law that it is much easier to travel from west to east and *vice versa* on the high Tibetan plateau-land than from north to south or *vice versa*. In the first of these two cases one follows the latitudinal valleys and has only to cross quite insignificant transverse thresholds as we had done now ever since leaving *Camp II* or for 33 days. The open country from *Camp II* to *Camp VIII* cannot be reckoned as belonging to the latitudinal valley in which *Camps IX—XXXIV* are situated, but it is in direct connection with it. From *Camp XXXV* and onwards as we diagonally crossed the high plateau-land and the innumerable small ranges

and fragments of old, nearly buried, ranges, the relief of the country in the direction of our route became more alternating from a hypsometrical point of view. For all these extended or short ranges which, as a rule, are stretching more or less from west to east, have to be crossed in small, flat passes or thresholds, and sometimes in more considerable passes. Such was the case on *October 11th* when we made 17.3 km. to the S. E. Hitherto we have spoken of a regular rise or fall of the ground. From *Camp X* to *Camp XIV*, for instance, the ground was rising gradually, but so slowly that it could not be noticed with the naked eye. From *Camp XXVIII* to *Camp XXXII* the ground was falling with the same regularity and with the appearance of being quite level. The distance between the two last-mentioned camps is 60 km., and the difference in height between them, 260 m. The average fall of the ground is here as 1:231. From *Camp XXXV*, on the other hand, which is at 5,033 m., we need only to march 6 km. E. S. E. to reach a height of 5,253 m. or a rise of 220 m., which is as 1:27 or nearly ten times as steep as in the former case. The heights (5,033, 5,253, 5,034, 5,055 and 4,978 m.) of a single day's march, or that from *Camp XXXV* to *Camp XXXVI* on *Oct. 11th*, give one an idea of wandering up and down more than hitherto. It is easy to see that we have crossed the range or system of ranges which, on the south, is bounding the long latitudinal valley we had followed for so many days. The greatest vertical amplitude during the day's march is thus 275 m. and the distance in all is 17.3 km.

The country is a labyrinth of rounded hills of soft material, partly red, partly greyish green dust in a much comminuted state of division. The ground is very barren and there is no grass. The erosion furrows are fairly deep-cut and their bottom is full of gravel. The hard rock is dark greyish green calcareous sandstone; the dust, sand and gravel is detritus of the same prevailing material. Where the hills consist of red clay they would be very difficult to climb after rains and the animals would then sink deep in this ground which now is dry and comfortable. The only vegetation now occasionally visible is moss. Our direction is now E. S. E. following a valley which comes from a pass. From *Camp XXXIV* the pass and the whole range to which it belongs had seemed to be very low, and still it took us two hours from *Camp XXXV* to reach its flat saddle with the height of 5,253 m. Its form was very comfortable and easy, though at this height all rising ground is extremely fatiguing for the animals. On the pass the loose gravel consisted of yellowish white limestone-breccia and the living rock was light red calcareous sandstone.

Pan. 49, Tab. 8, shows the relief of the surroundings of this pass. To the N. E., north, west and S. W. are the rounded cupola-shaped hills which are the culminating points of the little range we are just crossing. To the south and S. E. are the southern slopes of the same. To the E. N. E., east and E. S. E. the view is quite open for some 6 or 7 days' march or more. The eastern horizon forms a

slightly undulating line which only at two or three points is interrupted by dark mountains. High ranges or snow are not in sight. No lakes are visible, only a few white patches which need not be salt. Some slopes are yellow as if covered with grass. The distance is, however, too great for allowing us to characterize the country. So much is clear: it is an enormous plateau-land so far as the eye sees, resembling the open ocean with flat rollers. Here, as well as elsewhere, one also gets the impression that the ranges nearly always are stretching east and west, and that they very seldom are continuous for any considerable length. It seems easy to pass to the S. E. without crossing any high passes. In the course of a month's journey we have also obtained a very graphic idea of the general morphological laws prevailing over Tibet as a whole. In the west, crossing the *Chang-lung-yogma*, we left behind us the wild accentuated peripheric country with its deep-cut valleys and its vertical lines in the landscape, and entered the flat open plateau-land with extremely flat valleys and prevailing horizontal lines. To the north we only saw in the distance the mighty continuous mountain ranges which belong to the *Kwen-lun* System and constitute the northern marginal ranges of the high flat plateau-land of Tibet. The latter, with its insignificant relative altitudes and its enormous absolute heights, we have to cross diagonally to the S. E. until we again reach the continental water-parting and the southern marginal ranges, all of them belonging to the *Transhimalayan mountain system*. The most graphic impressions of the mountain country as a whole, one always gets from the passes. From them one dominates enormous areas of country without being preoccupied by too much details. It is the great characteristic features one sees from them. From this point of view as well, the panoramas are a very great help to the maps and to the description given in the text.

We leave the valley which goes down from the pass to our left, and cross the slopes to the S. E. The view to the south which was hidden from the pass, now by and by becomes visible. To the S. E. is a black range of moderate height stretching east and west. The peaks of its eastern half are pyramidal, those of the western rounded. There seem to be some easy passes over the range, though in this respect it is easy to make mistakes. Between us and the range there is an open latitudinal valley. The country is extremely desolate and there is no sign of animal life, no tracks, not even dung, and water is nowhere to be seen. The ground is red, yellow and white. Only yapkak is growing here. Between low, flat hills we follow a shallow valley without gravel, which finally emerges into the latitudinal valley, the chief erosion bed of which is directed to the N. 65° E., though the fall of the valley, as usual, is difficult to determine. It is situated between low hills of the finest red, green or yellow dust. Even in its bed there is no gravel. Only occasionally there is a narrow belt of fine gravel on the slopes. At the lee side or east of every

single yapkak plant there is a little ridge of coarse sand remaining as a testimony of the prevailing W. S. W. wind.

A short distance farther S. E. there is a second erosion furrow, broad and shallow and with some poor grass at its southern side. Probably both these beds join. From the second bed the ground slowly rises again amongst very flat hills crossed by dry, shallow beds. We reach a low threshold 5,055 m. high. From it a comparatively narrow valley goes down, cut through grey, dense limestone cropping up at some places. Farther down in the same valley there was quartz sand with cement of calcspar. At the foot of the hills a dry brook was directed to the E. N. E., with which our valley joined. At *Camp XXXVI* there was not a drop of water nor had any been seen during the whole day's march. Near the camp a fox was seen, otherwise, only the usual ravens, obviously the same that had followed us for many days.

Pan. 51A and 51B, Tab. 9, taken from *Camp XXXVI* shows, to the N. W. and north, the little range we had just crossed. To the N.  $46^{\circ}$  E. is a very distant mountain rising above the even line of the eastern horizon which continues uninterrupted to S.  $75^{\circ}$  E. and shows how very flat and open the country is in that direction. To the S. E. and south again, mountains are raising their irregular crests, but high mountains are nowhere in sight.

To *Camp XXXVII* the distance is only 8.7 km., and we are again rising 151 m. to 5,129 m., or at a rate of 1:58. The plain we now are crossing is undulating, and its drainage bed is directed to the N. E. In front of us there is a new range, which we have to cross in a new pass; our course is, therefore, directed towards the part of its crest which seems to be the lowest. Grass again begins to appear in the barren landscape. It grows on a kind of platforms, about 1 m. high and consisting partly of gravel, partly of sand.

We enter the transverse valley coming from the next range. Its dry erosion bed is very extensive, 2 m. deep and about 200 m. broad, showing that a good deal of water occasionally goes down through it. In this bed finally a pool of water was found. As it had snowed during the night our position needed not to have been critical, even if no water had been found. Most of the snow had disappeared at 10 o'clock a. m., but at protected places some of it remained during the whole day. The northern slopes of the southern mountains also remained white.

The bed proved to come from a valley which, where it is at its narrowest, is only 50 m. broad between strongly eroded walls of living rock of grey limestone. Very low yak-grass and moss is growing here. In its bed, which is covered with sand and gravel, there is a little brook, which is mostly frozen, but has open running water at a few places. A little higher up, the valley narrows to a real gorge, only 4 or 5 m. broad between solid plates and slabs of limestone standing vertically

like side-scenes in a theatre and being from 1 dm. to 1 m. thick and about 6 m. high. Just above this narrow place the little valley is again surrounded by soft hills at one place pierced by a vein of calcspar in large crystals and two or three meters thick. The valley is winding, sometimes being only 10 m. broad, at other places 100, but always sharply marked. From the sides, small tributary valleys enter; one of them contained a little brook from a spring. The principle brook of the valley is running under thin sheets of ice. Dung of wild yak and kyang is abundant. From the S. W. another valley of the same size as the one we are following joins it. To the south a red range is visible since the landscape has become more open. In a wide part of the valley, where grass, fuel and water were to be had, *Camp XXXVIII* was pitched.

From E. S. E. to S. W. stretched an irregular range, flat and denudated as usual, as is to be seen from Pan. 50, Tab. 8, but still tiring for animals which are not accustomed to the great rarefaction of the air. To the west, north and N. E. is a part of the little range we had just crossed.

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## CHAPTER VI.

### CROSSING THE KOKO-SHILI RANGES.

On *October 13th* we went 11.4 km. to cross the next mountain range which brought us chiefly in a south-eastern direction. The great flatness of this range will be realized from the following three absolute heights: at the northern foot 5,129 m., at the southern 5,207 m. and the water-parting saddle between them 5,306 m. The rise from *Camp XXXVII* to the saddle is, therefore, 177 m. or as 1:40, the distance being 7.1 km., and the fall from the saddle down to *Camp XXXVIII* is 99 m. or as 1:43, the distance being 4.3 km. For being in a mountain range, the gradients are, therefore, insignificant. From these figures one gets, however, a good conception of the flatness of the country. A difference of 177 m. between the crest and the base of a mountain range is not much. The system of small ranges we traversed in this region seems to be the western continuation of the *Koko-shili* Ranges or possibly the *Buka-mangna* in the east.

Still the march of October 13th was not easy, as it consisted of going up and down among hills the whole day. We followed the principal transverse valley to the S. E. From the S. W. a considerable tributary enters without a brook. A good deal of snow was still left on these altitudes. The red principal range was now partly visible on our right, and on our side of it, there is a small rugged rocky ridge. In the valley there is a little brook and some ice. Tributary brooks come from several of the side valleys. Our valley is now about 30 m. broad; its bed is full of fine gravel. Higher up there is no more water and the snow has disappeared. In the neighbourhood of the base of the pass there is again a little water; at places where it seems to disappear it only flows below the gravel. At one place a side brook had even formed a little waterfall now of solid ice and only 1.5 m. high — a very rare phenomenon on the Tibetan highlands. The rock is here a dark grey, dense limestone, very weathered and rotten. The view from the pass is not encouraging. To the S. E., south and S. W. a distant view is hidden by a labyrinth of near hills. To the E. S. E., east, N. E., north and N. W., everything is also hills situated in our vicinity. Only to N. 57° W. and N. 71° W. and generally in the



direction from which we came, the country is open to a very great distance, and still we get a glimpse over and beyond the small ranges we have crossed — of the *Kwen-lun* Mountains (Pan. 52, Tab. 9).

From the little pass we go down for a while, but finding that our descending valley turns to the east in a labyrinth of small hills and knolls we turn more to the south going around a red mount, which had been visible from the pass. Therefore, we must take a second little threshold. In the depression between the two, one could see level land to the N.  $49^{\circ}$  E., and, in the same direction, a depression which may be a considerable lake, though this could not be made out at this distance. The level land was no doubt the E. N. E. continuation of the great latitudinal valley we had crossed two and three days ago. Beyond the second threshold we go up and down through an intricate labyrinth of red hills, sometimes on their slopes, partly in beds, and sometimes crossing from one drainage system to another. The country is barren, there is no grass, at the most, moss or some yapkak plants. At many of these slopes the ground consists of hard, frozen mud, which, during the summer, must be floating just like lava, as could easily be seen from its regular cracks and fissures and from the arrangement of the gravel forming regularly rounded concentric belts, in which the flat stones stood vertically. Living rock, composed of dark grey dense limestone stood at one eroded bank. Farther on, the limestone was red and fine-grained. All the rest of these hills is very fine, red dust, detritus and débris of the same limestone. The whole landscape had, therefore, a reddish appearance, though yellow and violet colours occasionally are mixed with the red. Farther on the rock is blueish black calcareous schist, and the ground becomes gravelly. The principal watercourse, which at one place contained water, is directed to the E. S. E. We follow it partly in its bed and partly on the slopes at its right side. The hilly landscape now becomes more open, though in front of us there is the black range we had seen before. To the right of our route a red rounded range was left. At *Camp XXXIII* everything was to be found, grass, water and fuel. In the hills to the north the *Ovis ammon* was living and the skulls of this animal were occasionally seen.

Pan. 53, Tab. 9, taken from this camp, shows the whole horizon from N.  $18^{\circ}$  W. around over north and east to south nothing but flat mountains, low or moderate. To the N.  $60^{\circ}$  E. a mount of curious shape and with unusually steep sides is rising above the rest. To the S.  $57^{\circ}$  E. the country seemed to be more easy, and this was the direction we were going to take next day. The country in front of us was absolutely unknown. Two days and a half ago in the latitudinal valley we were crossing then, obviously the same in which Rawling's *Lake Markham* is situated, we had crossed the route of Wellby and Malcolm, who from there had travelled E. N. E. on their memorable journey. In the small difficult mountains we had just

crossed we also, to judge from Rawling's map, along a very short stretch came in contact with his route. But to the S. E. in the country we were now going to cross, no European had ever been.

Having left the little range behind, we had open and favourable country to the S. E. and E. S. E., in which direction we marched on *October 14th* for 12.3 km., descending in all 107 m. or at a rate of 1:115.

First we cross the erosion bed of *Camp XXXVIII* and soon after it another which joins it. A few minutes later there is a third bed joining the first two and together with them piercing the hills to the south of our route. The ground lies in very flat undulations, forcing us up and down at very insignificant gradients. After a while we again cross a flat trough from the edges of which several dry watercourses gather to one principal erosion furrow piercing the range of hills south of our route. Through the opening of its valley the country to the S. 15° W. seems to be comparatively level, at any rate no high mountains are visible, only low, dark ridges at a great distance. The ground is gravelly and light reddish. To our left are low rounded red hills forming a ridge which farther on becomes higher and is alternately black, red and dark violet.

Crossing a very insignificant flat threshold, we enter a new open trough bounded by the same ranges as the previous ones. Some watercourses from the mountains to our left are crossed. They join and pierce the range to our right in an open transverse valley, through which we see to the S. 30° W., a fairly considerable rounded peak with snow, being the highest mount visible now and still at a distance of 5 or 6 days' march. The country we had seen to the S. S. W. through these gates as through the openings of a gallery, seemed to be at a lower level than the region where we passed. Here grass was abundant, forming stripes and belts in the sand and gravel. It was a perfect steppe of good yellow grass. *Camp XXXIX* was pitched at the foot of a red hill where a rather big erosion bed went down southwards. It was 85 m. broad and 3 m. deep and contained some running water above the camp; it was directed to the south.

From a point a little elevated above its surroundings and situated 1.5 km. west of *Camp XXXIX*, Pan. 54A and 54B, Tab. 9, was taken showing both the moderate range to the N. N. E. and N. E. and the low range pierced by the different watercourses. To the right of S. 87° E., where the country appears very open, our route continues towards *Camp XL*.

Had the march from *Camp XXXVII* to *Camp XXXVIII* formed a convex line over a flat range, the march from *Camp XXXIX* to *Camp XL* formed a concave line crossing a very flat depression. The direction was E. S. E., the distance 10.5 km., and the diminution in height 100 m., as *Camp XL* had a height of only 5,000 m. The rate of the slope was thus as 1:105.



LOOKING S 13 E FROM CAMP 38.





A STEEP MOUNTAIN SEEN TO THE N 60 E FROM CAMP 38.





CAMP 38 (THE STEEP MOUNTAIN IS SEEN TO THE RIGHT).







A KILLED WILD YAK.





THE VALLEY OF CAMP 41.





CAMP 41.

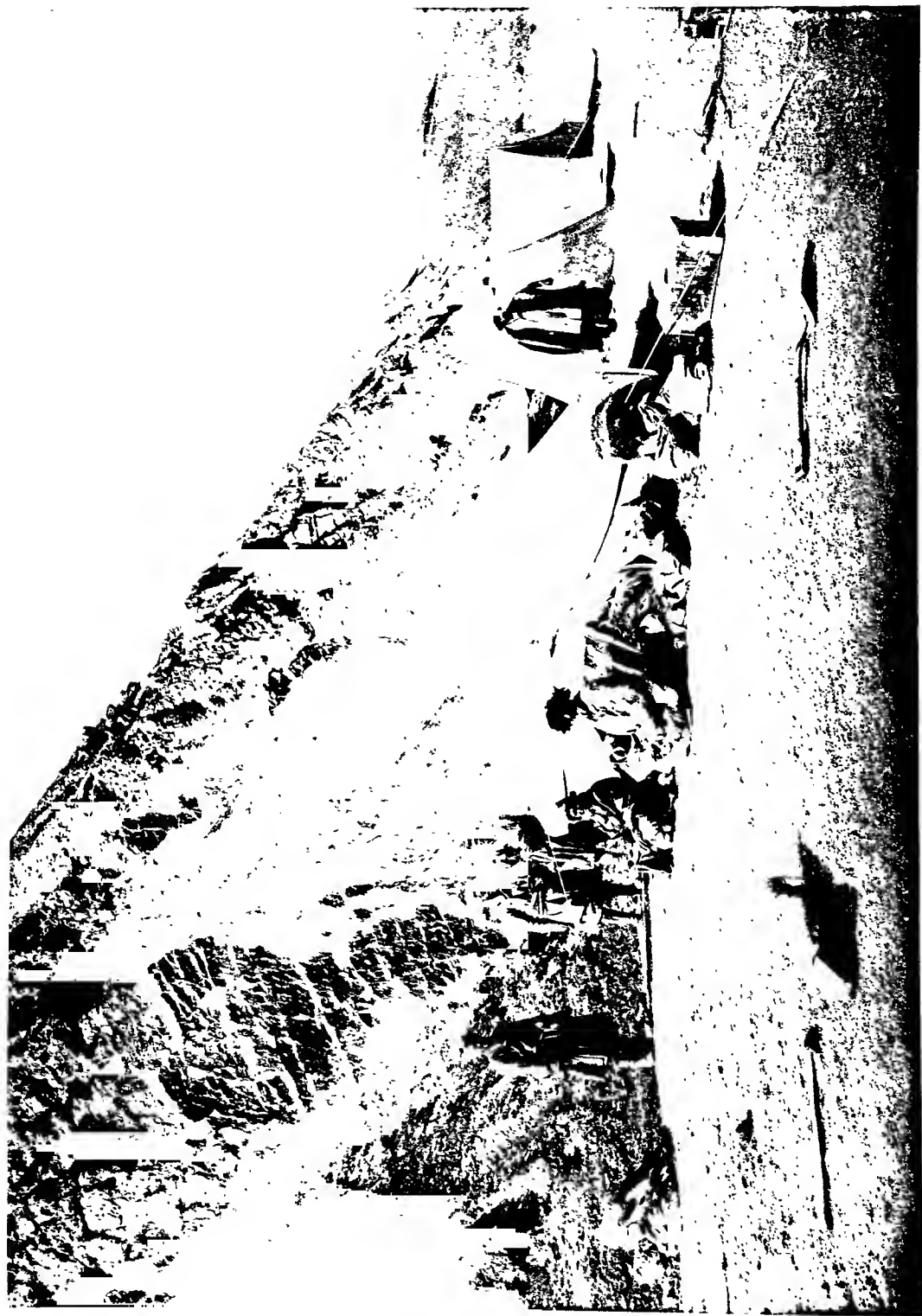




THE RESTS OF A WILD-YAK.







VIEW TO THE N. N. W. IN THE VALLEY OF CAMP 41.



In the beginning of the march the ground is a little undulating, a low threshold does not even reach the height of the *Camp XXXIX*. From here the view is about the same as before, and the relief of the highland is a multitude of short ranges, flat and stretching chiefly from west to east with latitudinal valleys between. The region we cross seems to be comparatively high, for as a rule we see three or four different ranges beyond each other, and nearly always they are so short that both the western and the eastern end of each of them is visible. There are no high dominating ranges or peaks, and no snow except that which had fallen during the last night and which had tinted different mountains white whilst others were bare, showing that the snow had fallen in unequal showers. In spite of its very changing relief in detail, the country as a whole seems fairly level where the horizon is at a great distance.

From the last threshold we follow a sharply marked valley downwards to the E. S. E. It has cut its erosion bed through solid rock of limestone-breccia. A spring comes up in its bed, and the ice-sheets from its brook continue the whole way until the valley opens out into the next flat basin. The slopes at the sides are partly soft material, partly rocks. The valley is sometimes only a few meters broad. Finally it emerges into the flat basin and here its watercourse turns to the S. S. E. in the direction of a small lake oblong from north to south, and now for the greater part dried up. The dry remainder of its bed resembled a light grey or white plain. Beyond this basin and south of it a rather low pass seemed to be situated, which ought to have presented a comfortable march. Continuing E. S. E. we cross two more erosion beds, the second of which was very considerable and proved that in the summer a large amount of water occasionally may flow down to the lake which at that season no doubt becomes filled with a layer of very shallow water. On the right side of this bed was an erosion terrace 2.5 m. high and perpendicular. In the bottom of the bed was gravel, of moderate size, and sand, but no silt. The water had only two or three months ago, flowed down in several branches some of which had cut themselves one foot deep in the general bed. On the left side of the latter there was no trace of a terrace. The bed gradually, and without a sharp boundary, went over into the gravelly plain of the flat basin. This basin, like a few other depressions on the plateau-land, is oblong in a meridional sense and, therefore, an exception to the general rule of the west-east stretching. On both sides were low hills, small promontories projecting here and there towards the lake basin like side-scenes.

There was grass the whole way to the great erosion bed. It was indeed a rather agreeable surprise to find grass practically everywhere in these high regions of northern Tibet, where one would have expected a very barren soil. In this respect north-eastern Tibet is very different. There, I had marched for days without seeing a single blade of grass. On the other hand wild onions were abundant in

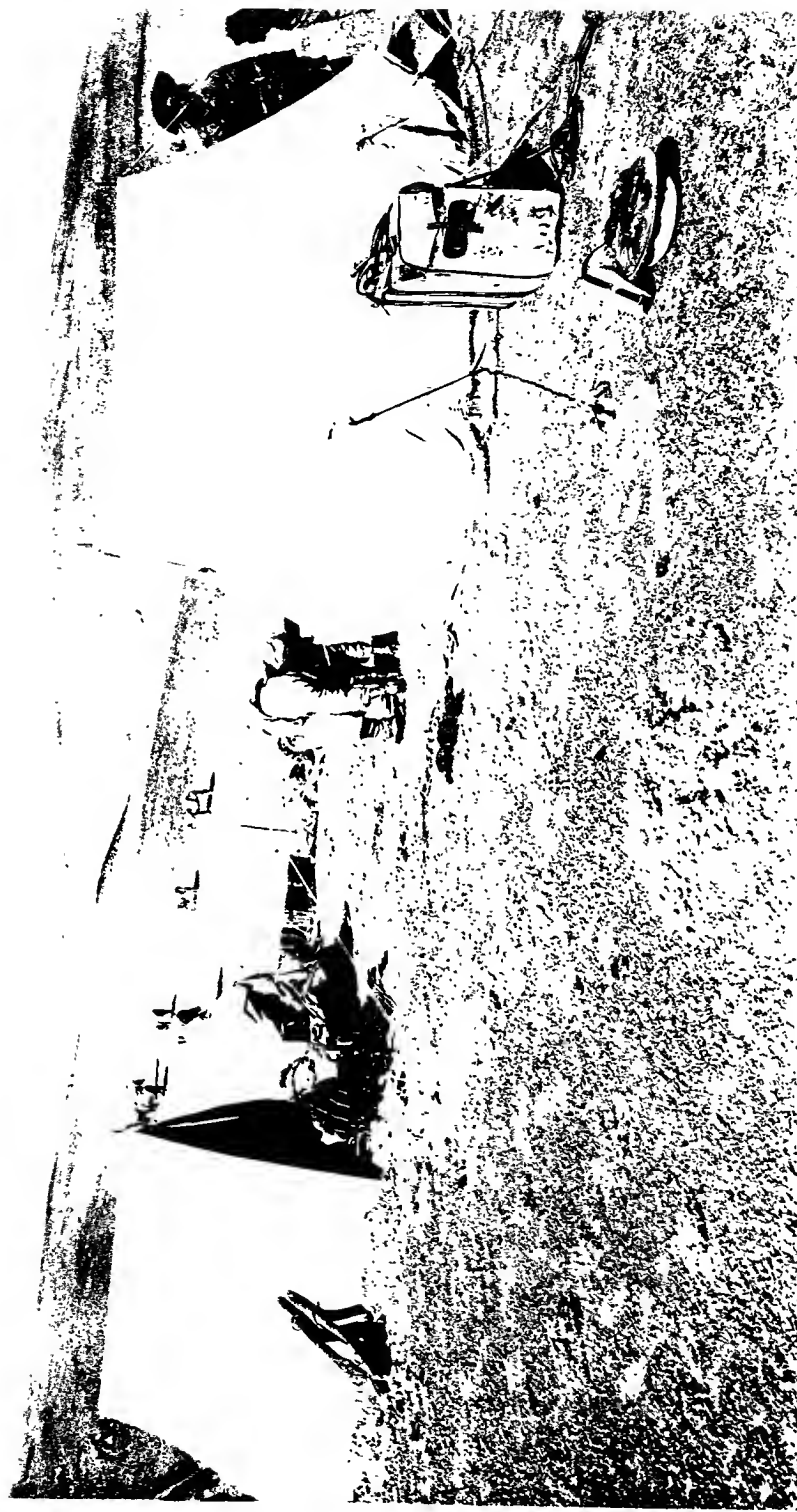
18th of October we had a temperature of  $-28.2^{\circ}$ , and as a rule the temperature of the day did not rise above freezing point.

From *Camp XLII* we continue S. E. on the soft slopes at the western side of the principal watercourse of the valley. The latter is broad and open as a plain, where antelopes and yaks were grazing. The animal life was otherwise represented only by a few ravens and one eagle. As usual, the ground was perforated by rabbits' holes, though the animals themselves at this season already were living under ground. The valley plain is surrounded by low, rounded hills on all sides. From them small shallow tributaries come down to the principal watercourse. Most of them were dry. To the east there was obviously a pass, a little higher than the one we crossed. It would perhaps have brought us to a more easy region than the one in which we lost ourselves.

The pass, 5,357 m. high, was flat, and grass grew all the way up. The view was not encouraging. To the N. W., from where we came, the country looked very favourable, it was like a sea of small red and violet ranges, but generally at a distance from each other and leaving plains between. The *Kwen-lun* Mountains had now disappeared completely. To the S. E., in the direction of our march, there was not a bit of level ground, everything was mountains, which, although not high, were a great hindrance to us. On the peaks of some of them, there was snow, though probably not eternal.

From the pass a valley goes slowly down to the S. S. E., receiving tributaries from both sides and with a little, partly open, brook. This valley seems to continue in the same direction until it flows into a little lake beyond the southern hills. From our route this lake was not visible, but it was seen by my scouts, who every day had to look out for a favourable passage. Now we left the valley and crossed a quite insignificant threshold, where Pan. 57, Tab. 9, was taken and which shows comparatively high mountains in the direction of our route. To the S.  $12^{\circ}$  E. and S.  $19^{\circ}$  E. were snow-covered peaks. The rock at *Camp XLIII*, quite near the threshold, was dark blueish grey calcareous schist.

On *October 19th* we proceeded 7 km. eastwards, rising 54 m. or as 1:130, for *Camp XLIV* was at 5,346 m. Halfway, we, however, crossed a valley with an elevation of only 5,187 m. The landscape continued to be difficult. From the camp we had to cross a series of ridges with small deep-cut valleys between. Finally we left them and went very steeply down into a main valley coming from the north and bound directly south to the lake, which from here became visible as a blue line. It seemed to be oblong from N. N. E. to S. S. W. and occupied the lowest part of a basin. To the south and east the latter was bounded by the dark, comparatively high, range we had seen from the pass of October 18th. From some of the thresholds east of *Camp XLIII* we had, however, been able to see that beyond and east of that range



CAMP 43.





THE VALLEY AT CAMP 43.









there were still at least two other ranges which had to be crossed before we could hope to reach more comfortable ground. The black range had the same stretching as the latter or N. N. E.—S. S. W., and so have probably also those east of it. We were obviously ascending a system of ranges tolerably parallel to the corresponding parts of the *Kwen-lun* System which, to the north of our region runs S. W.—N. E. The same stretching is also seen with *Lake Markham* and the ranges surrounding it. It is impossible to say if we, by making a round-about way to the north or south, would have been able to avoid the system of ranges we crossed between *Camps XLII* and *XLVII*. It seems to be most likely that we crossed a system that continues to the W. S. W. and to the E. N. E. and afterwards east, and thus is situated south of Wellby's route. This system of ranges towers up at a relatively more considerable height above the general surface of the plateau-land. The small valleys and watercourses eroding it in all directions are also more deep-cut and energetic than in the flat regions we had left behind.

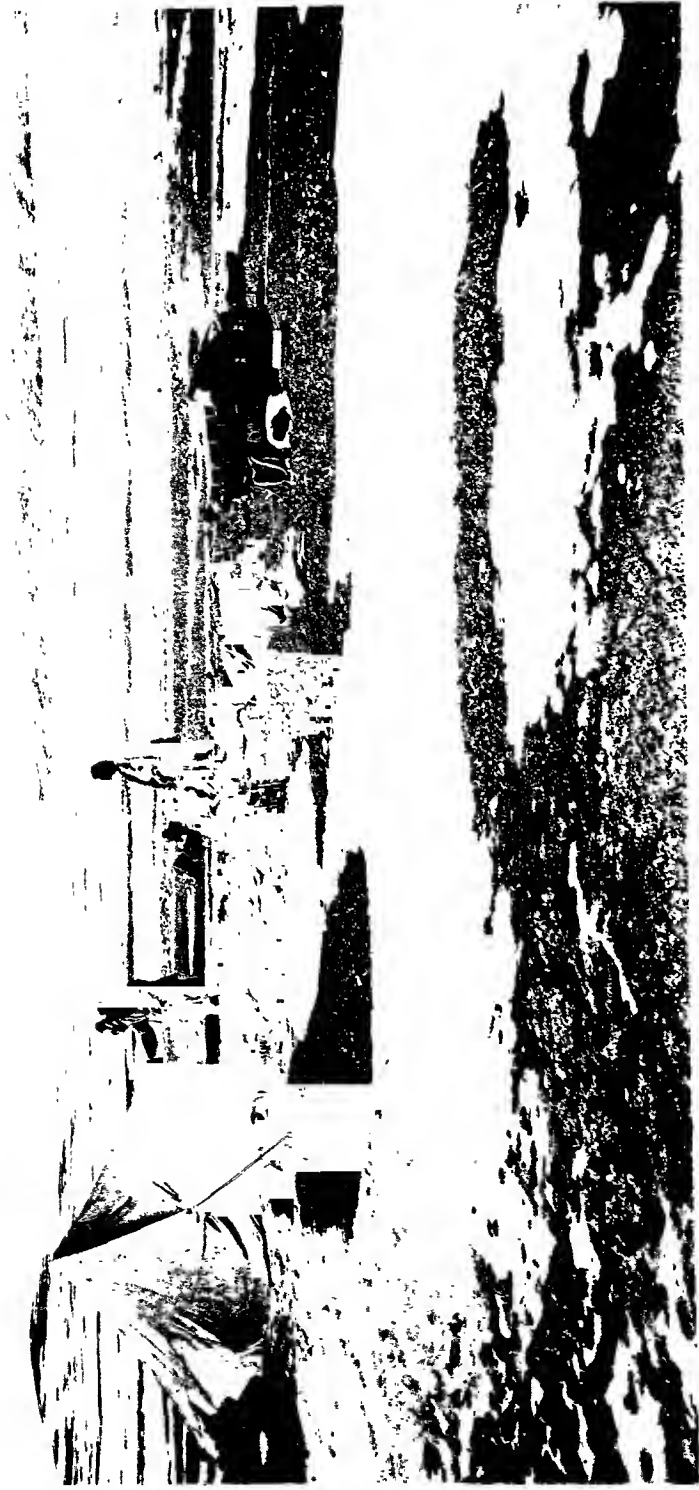
In the middle of the valley that goes to the lake, there is a broad watercourse with a 2 m. high erosion terrace at the left or eastern side, along which a little brook, which is mostly frozen, is flowing. At the right or western terrace there is a brook from springs. In its center, the bed is comparatively most elevated, and the erosion, which in summer may be active, goes on along the side terraces.

On the other side of the valley that goes to the lake, we again ascended and moved up in the valley of a tributary which had cut its bed 8 m. deep. The rock was here greenish grey sandstone. The valley receives tributaries from both sides, and all of them, although insignificant, contain water or ice. The region is high-alpine. There is some grass, some yak-grass and moss, small pools of water between tussocks of grass, and a good deal of gravel. This kind of ground is very tiring, especially as it rises slowly to a flat pass with some snow on its top and ice-sheets at its base. The whole region must be a quagmire in summer, very difficult of access. Now everything was frozen. A little farther on, *Camp XLIV* was pitched at an elevation of 5,346 m., in a trough, surrounded by mountains on all sides. The watercourses from them gathered in a brook which seemed to be directed to the south and probably then turned S. W. to the lake. The region was very inhospitable, so much the more so as a heavy snowfall began at 7 o'clock p. m. hiding the poor grazing still to be found at this great height.

Pan. 56, Tab. 9 from *Camp XLIV* shows us, from the N. N. E. to south the dark continuous range stretching N. N. E.—S. S. W., which we had had in sight for two or three days. On the panorama it does not seem to be very high, but at these altitudes and for a dying caravan it is very hard. Straight to the east the saddle which we used is visible. The one N.  $73^{\circ}$  E., situated just to the left of it, was perhaps a little lower, but lay out of our course.

On *October 20th* we started for this pass, which proved to be the highest we had hitherto had to conquer on the plateau-land, being only 169 m. lower than the *Chang-lung-yogma*. *Camp XLIV* had an altitude of 5,346 m.; the pass was 5,611 m. high giving a rise of 265 m. in a distance of 4 km., or at the rate of 1:15, which indeed was very steep under the prevailing circumstances. *Camp XLV* had an elevation of 5,386 m, or 225 m. below the pass; the distance being 6.2 km., the rate of fall is as 1:28.

Crossing several small erosion beds, we keep to the east over barren, gravelly ground, now everything covered with an unusually thick and uninterrupted sheet of snow which, as a rule could have been 3 inches, but became thicker the nearer we approached the pass. Living rock was found only on the pass itself and consisted of greenish grey quartzitic sandstone. The view I had hoped to win from this height was hindered by a new snowfall, which was driving the fine dry snow in clouds around the mountain crests. Only occasionally I got the impression of a plain being situated from N. 35° E. to N. 60° E. and being of a yellow colour. It seemed to be rather distant and obviously S. E. of the mountain system we were now crossing. Straight to the east is a high part of our range which conceals everything in that direction. To the S. 70° E. one only suspects through the clouds the existence of two small ranges, and beyond them the ground seemed to be level. One of my men, whom I had sent up to this pass the previous afternoon, had reported that the ground to the S. 50° E. seemed to be a comfortable plain so far as he could see, and such also proved to be the case. To the S. 76° E. at a very great distance, he had seen a considerable group with eternal snow, and to the N. 60° E., another snowy mount not less high. Unfortunately these mountains were now completely hidden. On the pass a west wind was blowing and the temperature was  $-10.1^{\circ}$ , due to the great height of 5,611 m. The valley down from the pass follows a winding course, generally to the N. E. Just a little below the pass there was a low threshold to the right, which may possibly have presented a more comfortable way down to the flat land to the S. E. The valley is rather narrow between rounded hills. Living rock is rare; at one place it consisted of a green schistose rock in so advanced a state of weathering that Professor Hennig has not been able to give its petrographic description. Lower down, the rock was dark, hard schist. The bottom of the valley is filled with gravel and is completely barren. In its bed there is ice everywhere. The snow was deeper on this side of the pass. From the right or south a tributary valley enters and the pass valley continues to the N. N. W. We leave it to our left and go eastwards over flat, soft, barren hills to a place where *Camp XLV* was pitched and where nothing except snow was to be had, not even the ordinary yapkak plants. The snow covered everything, and dung was difficult to find. Two yaks appeared at this desolate place. Two men were sent eastwards



CAMP 46.





LOOKING W. FROM CAMP 46.





to reconnoitre, as the single way of saving the rest of the caravan was to get out of this labyrinth of barren mountains.

On *October 21st.* we went 7.2 km. E. S. E. *Camp XLV* was at 5,386 m., *Camp XLVI* at 5,390 m., or nearly at the same level. Between the two is the second pass of this system, being 5,491 m. high. The rise to this pass is, therefore, 105 m. in 4.7 km. or as 1:45, and the descent 101 m. in 2.5 km. or as 1:25. The route goes up and down over flat hills and through gravelly furrows, which nearly everywhere contain ice-sheets as springs are very numerous. On the little pass it snowed again and very little was to be seen of the landscape around. Hitherto snow had been comparatively rare, but as soon as we came up into these high mountains, it snowed day and night, though never in great quantities. The snow did not seem to have any tendency to accumulate into great masses, for it evaporates very quickly during sunny days. Sunshine and precipitation are generally changing many times in the course of one and the same day, as was the case on *October 21st.* So much could always be made out from this pass, that a mountain rose in front of us to the east.

Below the pass the hard rock was augit-hornblende-diorite-porphyrite. In the valley going down to *Camp XLVI*, there was more snow than hitherto.

The next day's march, on *October 22nd*, was 11.1 km. to the S. E. *Camp XLVI* was at an elevation of 5,390 m., *Camp XLVII* at 5,223 m. In the middle there was another pass 5,501 m. high. We had 5.5 km. to ascend 111 m. or as 1:50; the descent was 278 m. in a distance of 5.6 km. or as 1:20. From *Camp XLVI* the route ascends flat, soft hills and crosses the erosion furrows between them. The whole land is snow-covered. There is no grass. Following a valley to the S. S. E., we reach the pass with an elevation of 5,501 m. Pan. 58, Tab. 9 shows the view over the hilly land to the N. E., east and S. E. To the S. 63° E. a part of the plain is visible; its colour is yellow and there is no grass. To the S. S. E., south, S. S. W. the hills are completely covered with snow. To the N. E. one sees the continuation of the range we are crossing, and it seems that the whole system continues in that direction, probably turning more and more E. N. E. and east. The range containing our pass is sending ramifications and flat hills down to the plain. At a greater distance nothing could be seen, as the horizon was concealed in dark clouds and snow-storms. Near the pass the rock was dark grey schistose clastophyric quartzite. From the pass we go down the snowy slopes, crossing some ravines and watercourses and finally reach a slope with yapkak, moss and grass amongst sharp-edged gravel. Thence we go down to the principal watercourse of this part of the range. It flows, though now dry, to the east across the plain and turns more and more south to the next lake. Crossing this bed and marching along the base of the hills to our right, we finally reach *Camp XLVII*, where we at last had left the extremely difficult mountain

system behind. This last day's march had cost the life of one fifth of the caravan, and the condition of all the surviving animals had by no means been improved by the hardships. In such cases as this it would always be better thoroughly to reconnoitre the region to make sure whether it is practicable for the caravan. After such hardships as these, one has only one thing to do to save the rest of the caravan and avoiding a catastrophe, and that is to find a place with good grass and water and give the animals a few days' rest.

So on *October 24th* we only covered 5.9 km. to the E. S. E. and S. E. to *Camp XLVIII* where the height was 5,153 m., or 70 m. below *Camp XLVII*, giving a rate of descent as 1:84. Our route follows the base of the hills to our right or S. W., where innumerable small, dry watercourses are crossed, all very shallow and some containing ice. To our left is the plain, partly covered with sand and gravel, partly with grass. To the east and N. E. it is bounded by low hills. To the north is a snow-covered range of moderate size, being either the continuation of, or a ramification from, the range we had just crossed. At *Camp XLVIII* the grass was very good, and there was a large amount of wild yak's dung. A spring gave good water which formed extensive ice-sheets. The soil consisted of sand and gravel. A short distance south of the camp is a salt lake which seemed to be oblong from N. N. E. to S. S. W., though, as a rule, it is difficult to determine the contours of the lakes from a distance. It was surrounded by a ring of white salt crystallisations, and was frozen hard. The whole day a S. W. storm was blowing which did not cease until dark.

From *Camp XLVIII* Pan. 59, Tab. 10, was drawn from north over east to south, the rest of the horizon being hidden by the hills at the base of which we camped. It shows all the hills visible in that direction, the greatest part of the lake, except its western shore, and to S.  $57^{\circ}$  E. it shows the low region we were going to cross the next day.

At about 1 km. S.  $16^{\circ}$  W. from the camp we found some curious ruins of three small houses. They had been built at perhaps 30 or 40 m. above the lake on the slope of the hills. Properly it was only square ground walls, which perhaps rather had served as a foundation for small black tents, for the walls were only 1 foot above the sandy ground around it. By digging we found that the walls continued about 1 foot under the sand, which had partly buried them. Grass was growing on the top of this sand, and the ruins may be very old. The walls consisted of flat stones of reddish quartzitic sandstone which was common in the neighbourhood. The two best preserved walls were built quite near each other and faced to the S.  $80^{\circ}$  E. The sides of the bigger were  $4.0 \times 3.1$  m., and of the smaller,  $2.2 \times 2.2$ . At the west side of the former there was a little appendix about 1 m. square. The third square was either obliterated or had never been completed. Quite close



ON THE CHANG-TANG OR NORTHERN PLAIN OF TIBET.



there seemed to be ruins of five other houses, though doubtful, as the stones were in great disorder. No tools or utensils of any kind could be found, and none of the slabs with the usual formula *om mani padme hum* had been hewn. The walls may be very old and they may remain as they now are for many centuries.

So far as my observations go, this place is situated at  $84^{\circ} 24'$  East long. and  $34^{\circ} 43'$  North lat. But it is very difficult to tell what object these old houses have served. If the walls have only served as a solid frame or foundation for very small tents, these tents cannot possibly have been inhabited by simple nomads or hunters, for they never take so much pains at a place where they are staying only for a few months, not even if they return to the same spot every year. On the contrary, their camps have always a very temporary character. On the other hand it is very unlikely that the walls we found should have been the foundations for stone houses, which now have disappeared. Nobody would have had any interest in pulling down abandoned houses.

Even as late as in 1792, an old road was reported to exist, which diagonally crossed the whole of Tibet from N. W. to S. E. It is entered on the Ta-ch'ing map as published by Dutreuil de Rhins, who calls it »Route de Khotan à Lhassa«. We find it, for instance, on the map of Tibet in Stieler's Hand-Atlas for 1875, where one point on it comes so near to my *Camp XLVIII* as:  $84^{\circ} 24'$  East long. and  $34^{\circ} 49'$  North lat. The road begins from *Khotan* and proceeds to *Polu*, crosses the *Kwen-lun* System, and continues over a series of named places, nearly all of them unknown to us, as *Ilitsi (Ilchi)*, *Aritau-tun*, *Atan-gol*, *Suget*, *Imam-Mula*, *Sari*, after which it follows the northern shore of *Chargut-tso* to *Nakdsong* and finally proceeds to the western shore of *Tengri-nor*. Still on Stieler's map of 1901, this road is to be found, though the point that should be identical with my *Camp XLVIII*, now is placed at  $35^{\circ}$  North lat. between *Suget* and *Imam-mula*. The latter place is represented as being surrounded by six small lakes. In the edition of 1904 of the same map, the old road has definitely disappeared. However, this road is, no doubt, the same one by which the famous general of Tsevang Rabtan, Tsering-dondob, marched in 1717 from *Khotan* across the *Kwen-lun* and the whole Tibetan plateau-land down to *Tengri-nor*.<sup>1</sup>

Now it does not seem unlikely at all, that the ruins of *Camp XLVIII* were a kind of halting-place or station on this extraordinary and impossible military highway. If this be true, this road must necessarily have followed the eastern part of the great latitudinal valley I have described, but probably not farther than the lake of *Camp XXXIII* or the region thereabout, from where it must have been in some comparatively practicable communication with *Polu*, *Keriya* and *Khotan*. The country

<sup>1</sup> Compare Vol. I, p. 264, and Vol. III, p. 38 and 55.

here is too little known to allow us a guess regarding this road. But it is not impossible that the mountainous country north or N. N. E. of the lake of *Camp XXXIII*, may be easier than the region farther west, where the high *Kwen-lun* Mountains have been explored by Stein. Regarding the S. E. continuation of the old road from *Camp XLVIII* onwards, we will see that I was fortunate enough to find a comparatively comfortable passage, where high mountains and difficult passes could be avoided. And, after all, there may, of course, exist other passages east of my route which are still easier. Under such conditions the ruins we found may have been a resting place and a head camp to which provisions were brought in advance and stored until the final dash of the invasion group was undertaken and which was freshly equipped at the relay station in question. By other means this adventurous and audacious expedition could hardly have been successful. Other stations of the same kind, perhaps larger and more elaborated, may also have been placed along the road of the army of invasion. Perhaps in the future when the country is better known, this problem will be solved.

On *October 28th* we marched 19.8 km. S. E. to *Camp XLIX*, where the absolute height was 5,205 m. or 52 m. above *Camp XLVIII*, thus having a rise of 1:381, or practically level ground. From *Camp XLVIII* the ground falls extremely slowly to the lake which, so far as can be judged from the whole formation of its basin, must be very shallow. We cross the very flat and broad watercourse from the north, and reach the shore, consisting of fine gravel and sand here and there interrupted with small elevated patches of grass. At several meters' distance from the edge of the water, there is a belt of black, rotten lake weeds, indicating that the salinity of the water is not so great that it kills vegetation. Quite fresh shore-lines proved that the lake grows bigger in summer when a certain amount of water from the melting snow comes down. Now everything was frozen and dead and hard as stone. To the south the lake was bounded by low hills. To the east the plain rose very slowly towards the base of the mountain ridge where our route was passing.

The latitudinal valley we are following is extraordinary in so far that it runs from N. W. to S. E., proving that there exist very conspicuous exceptions from the rule that the valleys and ranges in this part of Tibet stretch from W. S. W. to E. N. E. With low hills to our left and the lake for a while to our right, we continue S. E. over flat ground, very rich in yapkak and grass and millions of rabbits' holes. One herd of antelopes had 60 individuals. Dung of wild yak is abundant. One eagle was seen. It should be noted that wolves, though not numerous, live nearly everywhere where we had passed. Not a drop of water, nor any ice was seen during the march. But a large number of small watercourses from the eastern hills, directed W. S. W. to the lake, were crossed. They were very shallow, and appeared only as narrow barren ribbons in the grass steppe. Only one of them,

coming from a comparatively open valley among the hills, was rather large and perhaps took its rise from the N. E. continuation of the mountain system we had crossed. Nearly all the snow had disappeared and only in protected ravines, small patches, driven thither by the wind, still kept their ground. The storm, which came from the S. W., made mapping and taking bearings extremely difficult. The great transporting power of the wind could again be studied. Yellow and grey clouds of wind-driven dust were constantly sweeping over the ice of the lake, which itself had a yellowish colour. From the steppe east of the lake also, heaps of dust and sand were removed by this penetrating wind, and sometimes the whole landscape vanished in dust-clouds. The ground seemed to be quite level, though we had reason to expect a very flat, hardly noticeable threshold between the basin of the lake and the area of the next basin. To the S. E. our scouts had found the country open and flat for a long way.

At *Camp XLIX* everything was to be had except water. Snow had, therefore, to be melted, both for the men and the animals. A comparatively large watercourse here crossed the plain in the direction of the lake. Near the camp were found two fireplaces with three stones that had been used as a tripod to support cooking-pots. The soot that once had blackened them had now completely disappeared and there was no sign of ashes left. They, therefore, seemed to be old. At another place an iron ladle of hemispherical form, was found. My Ladaki hunters assured me that it was of the kind which is used in casting lead bullets. It had been exposed to the weather a long time for it had two or three rust holes. Already here at  $34^{\circ} 33'$  North lat., we thus came across signs of men, probably hunters, unless these remains were connected in some way or other with the ruins N. W. of the lake.

On *October 29th* the march goes S. E. for 11.2 km. to *Camp L*, where the height is 5,125 m. or 80 m. below the previous camp, giving a fall of 1:140. We crossed the great valley diagonally in the direction of a black promontory on the western side, which had been in sight ever since *Camp XLVIII*. The floor of the valley seemed to be perfectly flat and there was no possibility of telling where the water-parting threshold separating the basins of the two lakes, was situated. There were some watercourses in different directions, but not until we had proceeded some kilometers from the camp, did they seem to turn eastward and to join the principal watercourse that was destined for the next lake. The flat threshold, however, seems to be situated rather near *Camp XLIX*. The black mountain bordering the valley to the west, consists of ridges and peaks, perfectly black, but also of some more rounded hills with grass. The living rock was chlorite-glaucophan-albite schist, as determined by Professor Hennig. Several small erosion furrows come down from these mountains, but also two or three fairly deep-cut ones. At the base of the black promontory could be seen the traces of a path which probably used to be

taken by wild yaks. The dung of these animals was very abundant everywhere; it was perfectly dry, and probably dated from the spring when water is to be had in the region. The skull of a yak found here, had belonged to an animal killed by man, as could easily be seen. Yapkak is very common. There was not a patch of snow left from the last snowfall.

Turning around the black promontory, we get an excellent view of the S. E. continuation of the valley and of the next round salt lake occupying the lowest part of a very flat basin. Nearly the whole area of its surface was frozen, and only in the middle there still was open water. Now not a drop of water reached the lake, but next spring, or early summer, when the snows were melting all around and the springs opened, it would again be fed. It was, anyhow, in an advanced state of desiccation, and belonged to the category of lakes which soon will disappear. In the S. E., at a considerable distance, the lake basin seemed to be closed by low hills, beyond which mountains without snow were rising. To the east, irregular ridges were seen. At about N.  $52^{\circ}$  E., two high peaks were seen at a very great distance, belonging to a range of considerable dimensions. This range may be the one observed by Wellby to the south of his route. Between us and that range, there was, of course, a mass of moderate ranges, the situation and stretching of which could not be made out.

Panorama 60A and 60B, Tab. 10, is taken from a point at 3 km. N. N. W. from *Camp L*. At the beginning of that panorama a glimpse of the last-mentioned range is seen. At N.  $89^{\circ}$  E. a more prominent double peak is seen rising above the nearest hills. To the E. S. E. the country is comparatively flat. The lake is still hidden behind small protuberances at the base of the western mountains, of which the nearest parts are visible to the south, S. W., west and N.  $58^{\circ}$  W. The hills to the N.  $22^{\circ}$  W. and north are situated on the eastern side of the great valley.

*Camp L* was placed in a shallow depression near the foot of the western mountains. In its upper part there was a completely frozen spring, and we had nothing else to do but to melt ice for the caravan, which takes many hours. Not far from the camp there were fireplaces found at two points and another head of a killed yak.

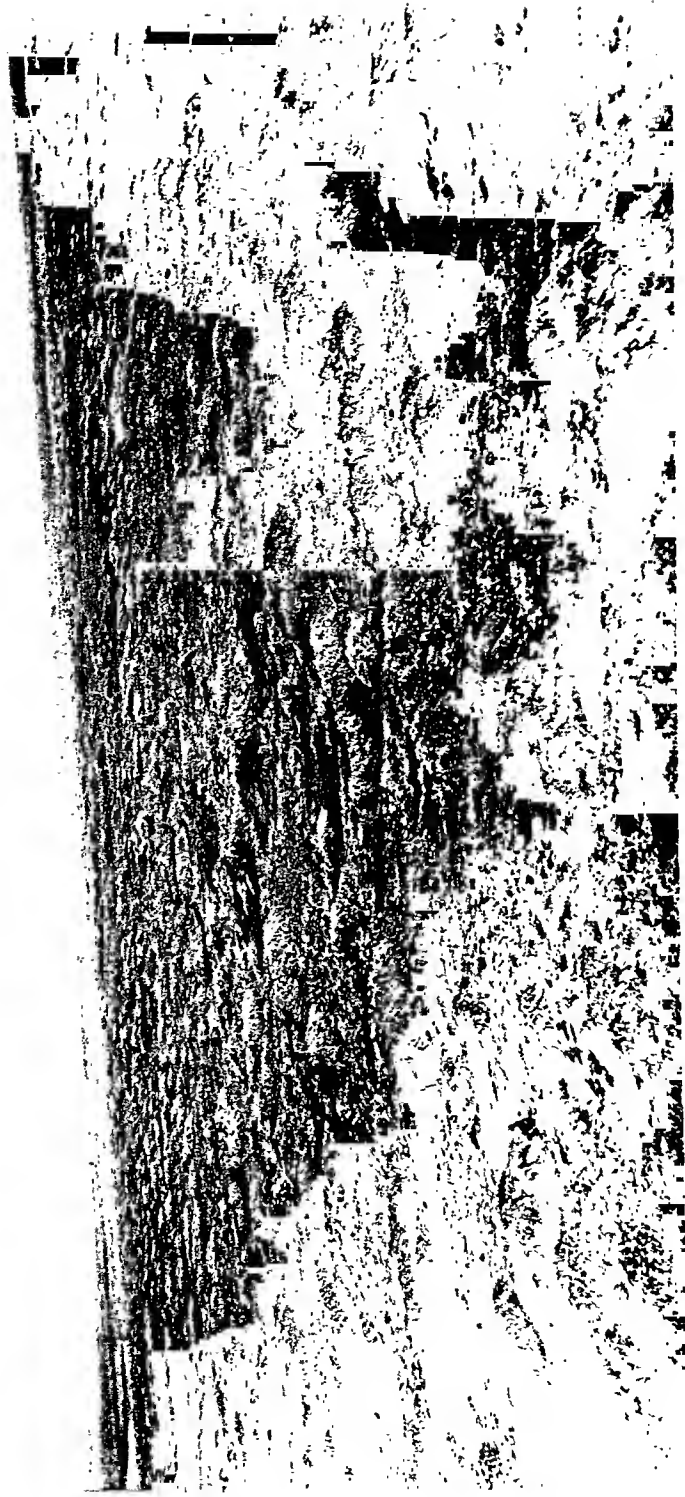
On *October 30th* our march was 7.1 km. to the S. S. E. *Camp LI* has a height of 5,040 m. or 85 m. below *Camp L*; thus having a rate of the fall as 1:84. Both on the 29th and 30th, the S. W. wind was very strong. The landscape remained monotonous. To our left we had an extensive steppe with grass and very flat undulating ground where, nearer the eastern side, the principal watercourse of the valley went S. E. to the lake. To our right we had the hills, at the base of which we now followed a real well-worn path, though it could not be said whether it had been trodden by wild animals or men. Small side valleys opened to the





CAMP 50.





LOOKING E. S. E. FROM CAMP 50.



plain. One of them was considerable and was, at the southern side of its mouth, bounded by a red ridge. The rock was fine-grained greenish chlorit-glaucophan-albite schist. Beyond this place we continued south amongst red, soft, sandy hills covered with grass. On the right side of a deep-cut valley, *Camp LI* was pitched amongst flat hills. The region was now visited by wild yaks. A little panorama, 61, Tab. 10, was drawn from N. E. to S. E. as the rest was hidden by hills in the immediate vicinity. The grass was good on the soft, sandy ground; fuel is plentiful, and running water was to be had from the last-mentioned valley. At three points near the lake, fireplaces were found, which my men supposed to be only two months old, as a part of the ashes was still left. A yak that was killed here had two Tibetan bullets in its body. Horns of tame Tibetan sheep were seen at one place. We were moving in a region which, at a less cold season, is visited by native hunters. In the night of *November 2d* we had a temperature of  $-29^{\circ}$  at this camp, where we remained four days for a rest.

To *Camp LII* we had, *November 3d*, 18.5 km. to the S. E. along the western margin of the basin. *Camp LII* had a height of 5,019 m., 21 m. below *Camp LI*. On the way between the two, we once crossed a tributary valley of 4,986 m. height, indicating that the lake must be some meters below that altitude, and a little protuberance with a height of 5,082 m. We were in a season of continual S. W. and W. S. W. wind, or rather storm, which more than anything else contributed to kill our animals and to weaken all the men, even the hardy Ladakis. Every morning I got new proofs of the transporting power of this wind, for my bed and everything inside my tent was covered with a layer of yellow dust that partly enters through the meshes of the tent-cloth itself. Until noon the sky was absolutely clear and blue in the zenith, but along the ground impenetrable clouds of dust and sand were sweeping, giving everything a grey or yellow appearance and hiding the view. In the afternoon the sky became covered with dark, compact clouds. The caravan, both animals and men, has a ghastly appearance, as they are perfectly covered with dust.

On undulating, soft ground covered with grass, we follow the base of the hills and cross an erosion furrow from the south. From there the ground is slowly rising to a little threshold between the hills we have to our right, and a little detached ridge. On its other side we again go down, crossing several small watercourses, all dry and without ice. We are approaching the lake which seems to be oblong from N. W. to S. E. At its northern shore there was a belt of open water. Some of my men who had been there, insisted that the water was fresh, which would indeed be surprising. The fact that the lake was partly open seemed to indicate salinity, though of course the constant S. W. wind also may delay the freezing of even a fresh-water lake.

After a second threshold, we go around the western mountains. The living rock is reddish, brown limestone-breccia. The slopes below the hills are soft undulating ground of sand and gravel and grass. The lake is now left behind; at its southern shore there are clearly visible concentric desiccation lines. *Camp LII* was pitched in a comparatively large transverse valley; in its erosion bed there was a spring with open running water and extensive ice-sheets. A short panorama from this camp, 63, Tab. 10, shows the mountains on the eastern side of the great latitudinal valley.

The next day's march, *November 4th*, goes S. S. E. for 13 km. The ground first rises from 5,019 m. to 5,082 m., and then again sinks to 5,046 m. These figures, however, do not give a profile of the basin and the threshold between it and the next, as we marched between hills where the relief of the ground appeared to be most favourable.

Just east of *Camp LII* a sharp ridge was standing, nearly meridional. Leaving it to our left we ascended a little flat threshold, covered all over with grass and much yak dung. Beyond it we came down in another little valley where the solid rock was gypsum, dark hard calcareous schist or argillaceous limestone and red conglomerate. During the whole remainder of the march we wandered up and down among very flat hills, crossing several dry watercourses, which probably all by some round-about ways, flowed to the last lake. The ground consisted, as usual, of red sand and dust and some fine gravel, the débris from nearly destroyed and denudated mountains, of which we only saw the strongly levelled ruins all around. A larger watercourse was crossed, and then the undulating ground and the small hills continued until we reached the camp near a bed with ice-sheets. During the day we had passed old fireplaces four times. In a side valley one of our men had seen a wall built of stone and yak horns; at the side of it was a bit of a rope which obviously had been used for leading tame yaks. Wild yaks and kyangs were seen in the region and their dung was very abundant. We had crossed quite a net-work of paths, obviously trodden by wild yaks, some of them worn down even to 1 dm. On a cliff was an eagle's nest constructed of antelope-horns.

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## CHAPTER VII.

### THE FIRST TIBETAN HUNTERS.

On *November 5th* our route goes 12.7 km. S. S. E. and S. E., rising from 5,046 m. to 5,158 m. and, before reaching *Camp LIV*, crossing a little threshold which looked as insignificant as many others, but later on proved to be the water-parting between two lake basins. The march may thus be divided into three sections: first, rising ground in and along the watercourse of a valley, then undulating ground at fairly nearly the same height and with a large number of dry watercourses going N. N. E., and finally, a short distance downhill in valleys.

At *Camp LIII* the rock was conglomerate, after which no solid rock was seen. The ascent of the little valley in which this camp was pitched was very gradual. It contains a ribbon of ice stretching at least for an hour up, but there is not a drop of water the whole day, and no snow. In this valley there was a Tibetan fireplace which seemed to be only one or two months old, as coal and ashes were still left. The visitors had obviously been hunters, as the skeletons of three yaks were found quite near. The paths of wild yaks were extremely common and now easy to recognize as they turn in quite unnecessary bends and windings around the sides of the hills. The landscape is rather accentuated; it is a labyrinth of flat, soft hills of red sand, with grass and yapkak, and with one or two, sometimes more, rabbits' holes on every square meter. Between these hills the shallow erosion furrows go down to the N. N. E.

In front of us to the S. S. E. and S. E., there is a black range of moderate size without any peaks, only cupola-shaped heights with a few patches of snow. From N. 30° W. over north and N. E. to S. 82° E., the country looked rather wild and mountainous, consisting of many ranges, ridges and peaks, the arrangements of which could not possibly be made out without penetrating this unknown country. Pan. 64, Tab. 10, gives an idea of it.<sup>1</sup> Above and beyond the rest to the N. 15° E., N. 17° E. and N. 38° E., comparatively high peaks with eternal snow are rising. They belong

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<sup>1</sup> Camp 54 and 55 on this panorama is a misprint for 53 and 54.

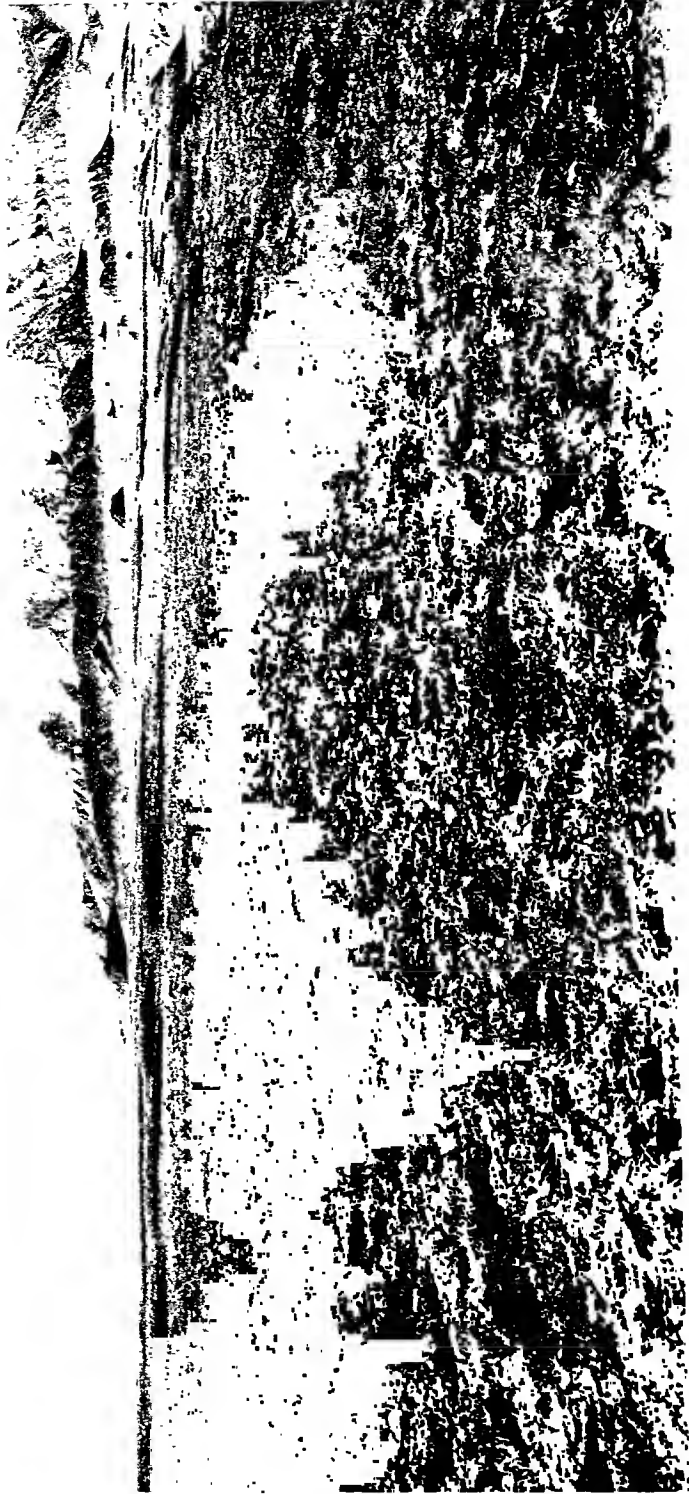
to a principal range of a red colour. The peaks to the N.  $48^{\circ}$  E., N.  $55^{\circ}$  E., and N.  $60^{\circ}$  E., probably belong to the same range. Between this range and us there are many other small ranges without snow, running, as it seems, chiefly N. W.—S. E. They are all red or violet in all possible tints, from light to dark red, and the beautiful colours give the same effect as the sun in the evening. To the N. N. E. is a depression surrounded by irregular ridges or ramifications. In this basin two white patches are visible. In the depression there is probably a little salt lake, though not visible from our route. At any rate all the watercourses we crossed during the middle section of the day's march meandered in the direction of that little basin which seemed to be smaller than others we had crossed. The landscape to the N. E. from the point where the panorama was taken, was one of unusual beauty and silent, solemn majesty.

To our right or at the west side of the basin, we had low hills the whole day which, however, at seasons seemed to attract a good deal of rain, to judge from a few rather deep-cut erosion beds. One of these came from a flat threshold from the S. E. side of which the ground slowly sloped down to a little valley, which soon became narrow as a gorge; this emerged nearly immediately in another with a gravelly bed and fairly deep erosion furrows. Here again was a Tibetan fireplace. It is directed to the E. S. E. and, after a few minutes, joins a somewhat larger watercourse than the two previous ones, bounded by very steep red hills of sand and fine gravel, covered with sparse grass. Here *Camp LIV* was pitched just above a spring of running water in the bed. The valley came from the S. W. but gradually turned more and more to the east.

The most interesting feature of this spot was the many human traces we found there. There was a fireplace, and three tent-places visible from the boulders arranged in squares, which had served as a protection for the tents. A fourth square of stones was so far unlike the others that the ground inside of it was dug out 1 m. below the exterior ground; it had two narrow entrances and had obviously been covered by a tent. A fifth square was like the first-mentioned. Here a pair of discarded Tibetan boots was found. Higher up the valley my men found another place with some 15 stone squares. The place had been visited by gold-diggers last summer, as could be seen from the freshly opened sand mounds in and along the bed. Down the valley a regular human path was running. The region was called *Lashung* as we were told later on. The chief difference between the constructions found here, and those of *Camp XLVIII*, consisted in the fact that the latter certainly were of older date and that they, as far as we could see, had nothing to do with gold-digging.

On *November 6th* our route goes 10.3 km. in a general S. E. direction, though at the same time describing nearly half a circle with its convexity to the N. E. *Camp LV* is 147 m. below *Camp LIV*, giving a fall of 1:70.





LOOKING N. E. FROM CAMP 53.





LOOKING E. N. E. FROM CAMP 53.







The S. W. wind was continuing with annihilating force and finely divided solid material was again swept towards the N. E. Every day this continuous transport could be observed and felt, — even the food was mixed with dust and fine sand. In the denudation and levelling of the Tibetan plateau-land, the wind is a factor of enormous importance. All the fine material is swept away and will at some other place serve for filling up basins. During these storms of the late autumn the sky, however, remained clear and blue as turquoise, and the sunshine was so sharp that even the Ladakis had to protect their eyes. The country appeared in red and yellow tints. Grass and yapkak plants were growing nearly everywhere, only the erosion furrows and the plain near the next lake, were barren.

To follow the valley of *Camp LIV* proved to be impossible. Our scouts reported that it rose to the south and led to mountainous regions impracticable for our weak animals. We, therefore, went down to the E. S. E., following the beaten road at the right slopes of our valley, in the bed of which there was ice at several places. The road goes into all side valleys and out around projecting slopes, and its height above the bed of the valley increases gradually. The red slopes at the left side are very steep; on the right side, more moderate. In the mouth of our little tributary from the right there was a round stone wall, a fireplace and the skeleton of a yak. In another valley there were again sand mounds of gold-diggers. They were seen at several places along the principal valley.

Our direction turns gradually to the S. E. and S. S. E. At the same time our route diverges more and more from the main valley which is becoming more open and finally opens out in the plain, where its watercourse turns S. E. and S. S. E. to the next lake. Our road goes up and down over tiring hill slopes with moderate heights at our right, consisting of nothing but detritus, red sand and gravel. These hills by and by become more steep, and often appear in curious formations of shelves and terraces. Finally, they become nearly perpendicular walls of red fine-grained calcareous sandstone together with conglomerate. The sandstone mountains are here pierced by a series of rather deep and fatiguing valleys opening to the plain and directed to the lake which now is partly visible. One of these valleys was easily 50 m. deep, and to reach its bottom, one had to follow the zigzags of the steep, native road. This valley comes from a considerable part of the red mountain group and from S. 65° W. It is bounded by steep, partly perpendicular walls of sandstone and conglomerate containing layers of rock salt. Lower down in the gorge solid rock is not visible. At the point where the road crosses the valley and just below an extensive ice-sheet, several springs come up, the warmest of them having a temperature of + 4.0°. Some were salt, but most of them were quite fresh. They join to form a little brook which on account of the high temperature of the water keeps running some distance down the gorge which here is bounded by steep banks

of pebbles and shingle and detritus material, but soon afterwards opens out into the plain. The floor of the valley was red from the sandstone gravel and white from salt crystallisations. In the upper reaches of this valley there were numerous yaks and antelopes. Of the latter, herds were also seen on the plain north of the lake. Having climbed up again on the southern side of the valley, we camped at the foot of a red mountain, where again a square wall was seen with a fireplace protected with a roof of stones. In front of us to the south was seen a cairn, *lamga teur* as the Ladakis say, showing where the road passes. Pan. 62, Tab. 10, shows the view from this camp. The rest of the horizon was hidden by the hills behind us.

On *November 7th* we continued the march around the eastern side of the great, red sandstone group for 11.3 km., generally to the S. S. W. In the course of this march the absolute height remains about the same, *Camp LV* being at 5,011 m. and *Camp LVI* at 5,016 m. The minima of the nights were some degrees higher than before, *e. g.* the night to the 7th of November — 19.4°, and the S. W. wind was not quite so strong.

From the camp our road goes steeply up to a hill from which the lake is again visible and proves to be small and round. Then we march up and down on very uncomfortable ground consisting of nothing but sharp-edged gravel forming mighty screes down to the western shore of the lake. No vegetation gets time to grow up in the gravel which constantly increases after every new fall and sliding of the destroyed rocks from above. The rocks rise in steep, sometimes perpendicular walls immediately to the right of our road, and are pierced by a series of deep-cut, narrow, wild gorges. From these issue narrow beds with their floors full of gravel and blocks. We have, therefore, to cross a series of screes with erosion valleys between. The rocks here consist of grey schistose clastophyric quartzite, and white quartz included in greyish green schist. Through the opening of one particularly large valley, considerable mountain cupolas were seen to the west, probably the highest part of the group. From this valley a brook went to the lake, among extensive ice-sheets. We are at an average height of about 50 m. above *Lashung-tso*, as we later on were told was the name of this lake, the western shore of which we slowly approached. Hares were numerous. On the nearly perpendicular cliffs above us two flocks of *Ovis ammon* of 9 and 5 individuals resp. were seen.

Farther on we had to cross an erosion furrow easily 100 m. broad and filled with boulders, sharp-edged blocks and gravel without any kind of cement or finer material between. Hills and slopes of black gravel fall down to the very shore of the lake. When we are nearest the lake there is a semi-circular stone wall with its convexity to the south. At *Camp LV* a similar construction was convex to the north, which seems to indicate that the mountain group acts as a wind-parting. The lake proved to be salt, though it was completely frozen over. Its colour was white





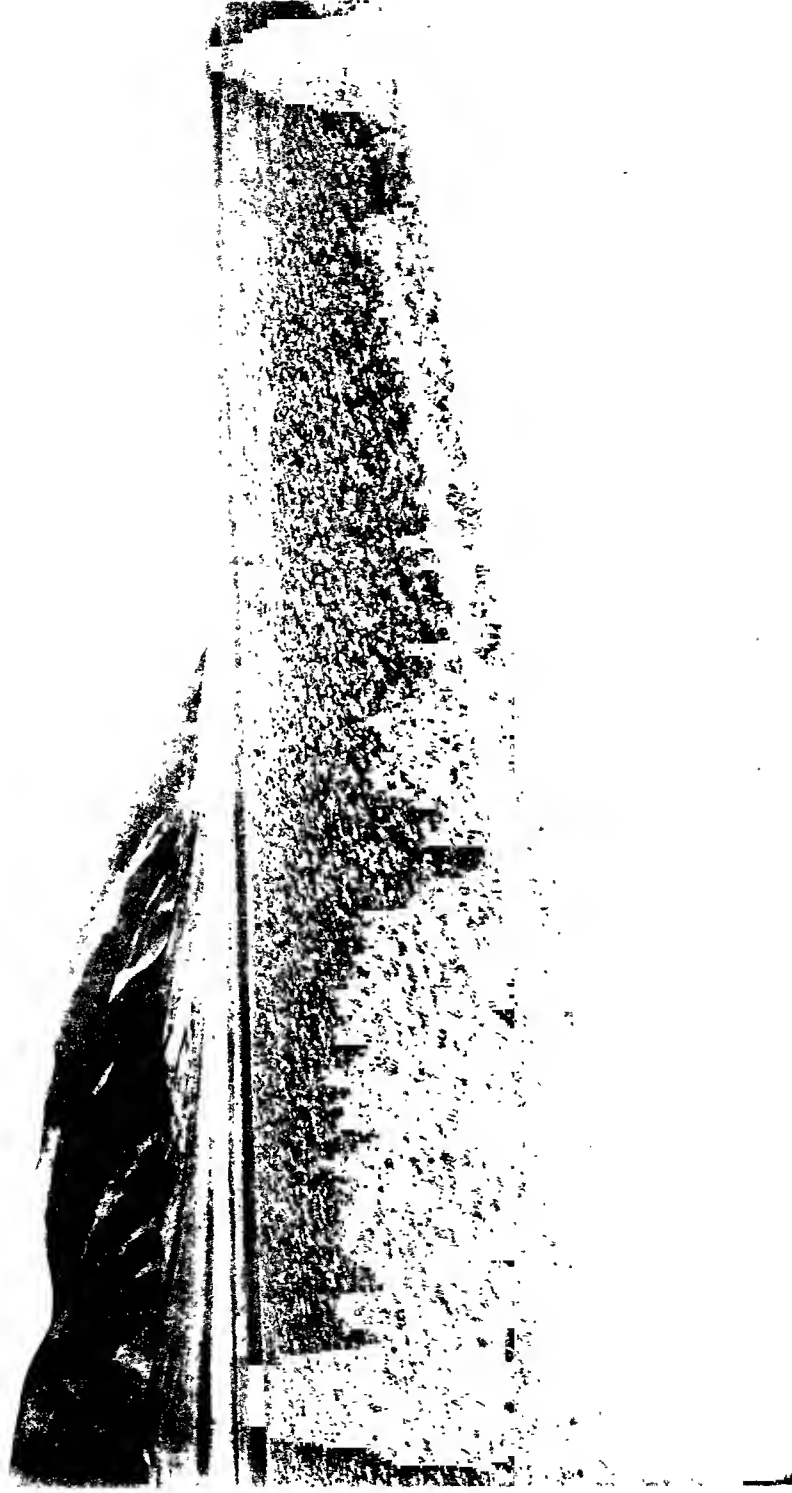
A RAVINE NEAR CAMP 55.





LOOKING S. W. FROM CAMP 56.





LOOKING N. W. FROM CAMP 56.



from porous ice, light green where the ice was solid, and violet and red near the shore from the colour of blocks and gravel on its bottom. Fresh water springs come forth at the shore. The lake seems to be shallow.

Beyond a projecting rock the view becomes more open to the south, where the mountain range, which we had to cross the next day, is rising. From here a panorama was sketched, showing the basin of *Lashung-tso* from N. E. to S. S. E. (Pan. 65, Tab. 10). Between the eastern mountains and the lake there seems to be a belt of flat level ground which becomes broader to the S. W. of the lake. Finally we go down from the gravelly slopes, the ground becomes more flat and the gravel more sparse, the lake is left behind and the distance to the western mountains increases. The erosion beds become broader and more shallow. The ground again slowly rises in the direction of the southern range. To the east this is bordered by rather low hills, red as is nearly everything in this region. They are rounded and chiefly consist of loose material, out of which, here and there, a little peak of solid rock rises; one of these had, from a distance, exactly the appearance of a *gompa*. Near the eastern shore of the lake a herd of some 50 yaks was seen. A flock of 20 antelopes crossed our route in the direction of the lake. We keep to the S. W. The ground is hard and comfortable, there is grass as usual. *Camp LVI* was pitched at the bank of a watercourse containing ice and a little brook. Just west of this camp yaks were grazing. We had obviously reached a region where these animals pass the winter. We had also reached the parts of Tibet where marmots are living; four of their holes had been seen on this day and two on the day before.

Pan. 66, Tab. 10, gives a very good idea of the lake basin of *Lashung-tso* and the mountains surrounding it on all sides, except the southern. The whole group to the west of the lake is readily visible with its steep slope down to the lake. To the east there is a system of more moderate hills.

On *November 8th* we proceeded 13 km. S. S. E. and S. E., crossing the southern range in a flat pass of 5,161 m. height. The rise is, therefore, 145 m. in a distance of 8.5 km., giving a rate of 1:59. On the southern side we have 4.5 km. to *Camp LVII* with an altitude of 4,994 m., or a fall of 167 m., which is as 1:27.

We have lost sight of the Tibetan road and ascend on hills and slopes and cross two dry watercourses bound to *Lashung-tso*; here the rock was grey limestone with veins of calcspar. In several small valleys there are ice-sheets; grass is abundant and so is yak dung. Approaching the pass in its valley we have a comparatively bulky mount to our right, from which watercourses go down both to the north and the south of the pass. A fireplace was seen in the valley. The pass is flat and easy. A new landscape opens up from it and the region we have just crossed becomes hidden. In front of us to the south there is a mountain range of moderate size and beyond

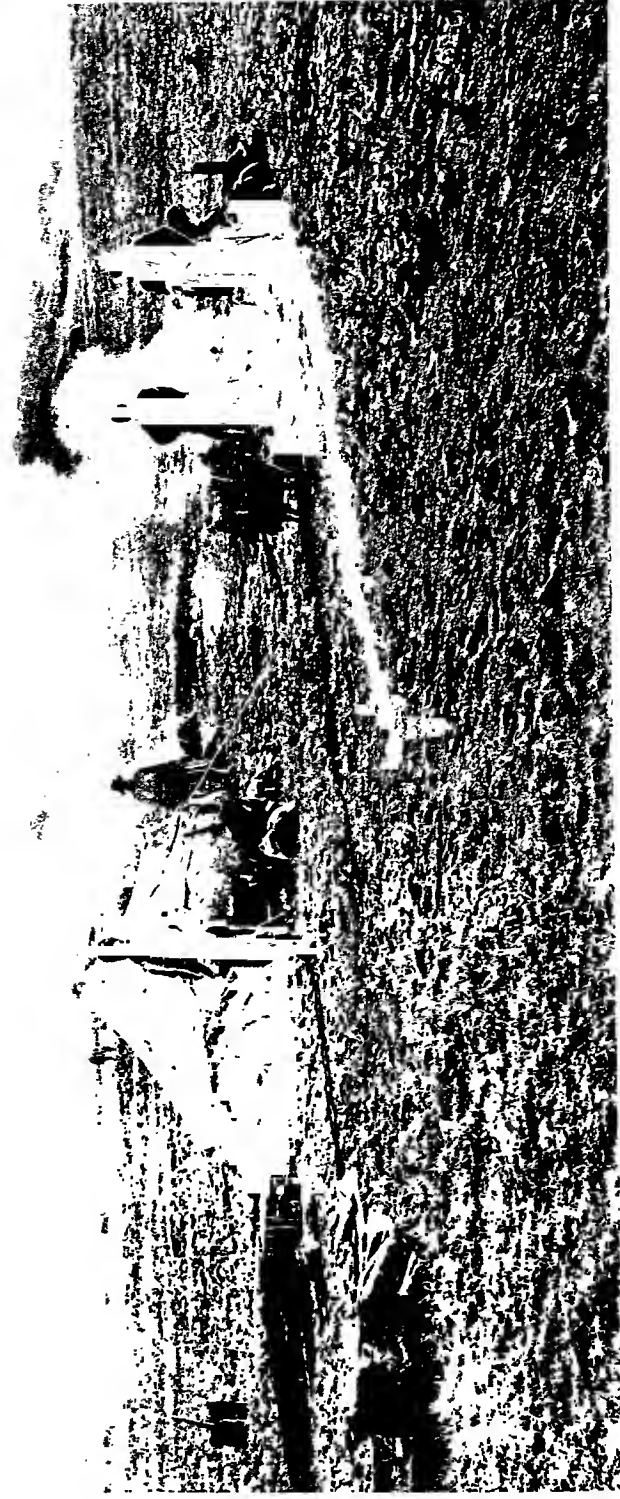
it, a snow mass. To the S.  $42^{\circ}$  E. (Pan. 68A and 68B, Tab. 11) is a cupola-shaped peak with some snow. As a rule snow groups had proved to be very rare in this part of Tibet, and those existing are small and cannot be compared with those in eastern Tibet. S.  $33^{\circ}$  W. some fairly high peaks are raising their heads. To the S.  $65^{\circ}$  W. there is a mount belonging to the range on which we are standing. To the N. W., N. N. W. and north is the mountain group west of *Lashung-tso* the same as the one on Pan. 66, Tab. 10, though from a somewhat changed perspective. Between our range and the southern mountains, there is a broad latitudinal valley, the floor of which is undulating and even a little hilly. To the south from the pass, two small depressions, perhaps containing some water, seem to occupy a part of the valley, and to the S. E. there is a lake, called *Kung-tsaka*, as we heard later on. A view from such a point as this is very instructive; one gets one's bearings and can make out in what direction one has to proceed. Now to the S. W. and south the mountains were too high, only to the S. E. did we have comfortable ground.

Going down between hills of red weathered limestone, we had soft ground as hitherto, as red as burnt bricks and with good yellow grass. The floor of the whole latitudinal valley showed itself in the same tints. Everywhere the tracks of kyangs were seen and a good many of wild yaks; a few of the latter animals were grazing in a side valley. The kyangs had been rare so far. Now they appeared in six different herds in the extensive valley. We know too little of high Tibet to be able to draw maps of the occurrence of the big game and its wanderings with the seasons. On a journey like this one gets, however, a very strong impression of the fact that in some regions there is no kind of big game at all, in others the yak is common, in others the kyang or both. The *Ovis ammon* may be met with only in rocky, steep, rugged mountains like those west of *Lashung-tso*. The marmot also suddenly made its appearance on our road, and there were no rabbits in the vicinity of the marmots' holes. Hares again became common around *Lashung-tso* after having been missing for many days. Only wolves lived everywhere, though never in large numbers. Only occasionally a fox could be seen. Bears seemed not to exist in these parts, at least we did not see a single one.

On the southern slopes of the range along which we now descended, the grass was so abundant that the tracks of the kyangs looked like red ribbons in it. It was softer than hitherto and even had a greenish tint. At *Camp LVII* there was a spring forming a round pool 15 m. in diameter and containing excellent fresh ice-covered water which, from the pool, continued in a little brook with extensive ice sheets. In its vicinity were Tibetan fireplaces and a little stone wall behind which hunters await the arrival of game at the pool.

On *November 9th* our route goes E. S. E. for 16.6 km. and falls 105 m. to *Camp LVIII* which is at an altitude of 4,889 m., the rate being as 1:158. We





IN THE LA-SHUNG DISTRICT OF CHANG-TANG.



had not been so low down as at *Camp LVIII* since *Camp XXXII* or 26 days' marches away.

The part of the latitudinal valley where we were now marching, slopes very gradually to the S. S. W. The western part of the same valley falls to the east towards the little salt lake, *Kung-tsaka*. Our route is crossed by many erosion furrows, some of which are filled from springs. Between them there are very flat undulations of red sand covered with grass. Antelopes and kyangs were seen, but only one yak. The day's march was very monotonous. At *Camp LVIII*, there was a spring and several fireplaces, some of which seemed to be only 15 days old. Dung of tame sheep was seen at two or three places.

To *Camp LIX*, on *November 10th*, the distance was 14.5 km., and the ground ascended 103 m. or at a rate of 1:141. The height at this camp was 4,992 m.

Strong S. W. wind as usual with clouds of dust and sand! The landscape is uninteresting and monotonous, soft undulated plateau-land with no considerable mountains in sight. Near *Camp LVIII* we cross a few ice-sheets, from springs, directed to the W. S. W. to the lowest part of the depression where lake *Kung-tsaka* must be situated, though the lake itself was never in sight. It looked like a flat white depression, but later on we were told a lake existed there. A larger erosion bed with a white floor and ice passed from south of *Camp LVIII* to this depression and received the above-mentioned ice-beds from the springs. Ascending amongst flat, soft, sandy hills we again got a fine view to the south where the dark little snow-covered peak appeared straight south; the same one that rose in the S. 42° E. as seen from the pass on *November 8th*, Pan. 68A, Tab. 11. At three places, Tibetan hunters had had their cooking-pots boiling. To the east the country is rather level with only small ridges and not a single snow-covered mount. To the E. S. E. there now appears a lake, which, as we found later on, is called *Gomo-tsaka*, intensely blue in its center and with very flat white shores, thus being a salt lake. The watercourses we crossed are probably destined to this lake. To the S. E. the country seems to be level and easy.

Leaving the hills, we had to cross a plain and directed our march towards the opening of a valley in the mountain range bordering the plain to the south. In the protection of a little spur, the camp was pitched near an open spring of fresh water. The name of this valley is *Lungnak*. Here was an ordinary camping place of Tibetans as could be seen from the several tripods for cooking pots around the spring. Pan. 67, Tab. 10, is taken from this camp, showing a contour of the hills to the north, N. E. and east and in this same direction, lake *Gomo-tsaka*, as well as some of the mountains farther south.

At a short distance up in this little valley the first Tibetan tent was found, inhabited by one woman and three children. Her two husbands had gone to *Gertse*.

The tent had been pitched here 17 days before. The family came from *Gertse* and had been 25 short days on the way. They had 5 yaks and about 20 sheep and used to stay at *Lungnak* for three months hunting yaks, kyangs and antelopes and living exclusively from their flesh and from tea. We had not seen a single human being in 79 days. In spite of our finding comparatively favourable ground nearly the whole way, we had lost 65 out of 94 ponies and mules, and less than a third were left. I made the observation that nothing was so dangerous for the animals as the strong S. W. wind. At *Camp LIX*, for instance, three of the best ponies died in spite of an unusually high minimum temperature of  $-16.3^{\circ}$ , but a regular storm had been blowing for some 40 hours. During these severe storms the animals do not eat, which contributes to their weakness. It is a long way across the Tibetan highlands! From one day to another the animals get weaker, and finally it comes to a point where their forces give way altogether. This moment is critical and it must be avoided until nomads are reached. It may, therefore, be a question of whether it would not be better to start two months earlier, though then another road must be taken as the *Chang-chenmo* cannot be crossed in summer. The treacherous soil which is like a quagmire when barren, is, as I have said before, a great hindrance in summer. But, on the other hand, the grass is soft and fresh and the animals may be kept in a better condition. I, therefore, believe that, taking everything into consideration, the summer and autumn is the best time for crossing the high plateau-land.

Our march from *Lungnak*, *Camp LIX*, to *Gomo*, *Camp LX*, accomplished on *November 12th*, took us 16.3 km. S. E. The latter place being at 4,843 m., was thus 149 m. below the first, and the descent was as 1:109, or a very insignificant gradient as usual.

At *Camp LIX* the rock was green albite-amphibolite which continued some distance in the direction of our route. The watercourse of the *Lungnak* valley had a considerable bed filled with gravel and ice. Lake *Gomo-tsaka* is left to the left at a distance of a few miles. It is situated in a very flat basin and is surrounded by plains. The hills north, N. E. and east of it are rather low. The peak covered with some snow and mentioned above, is now left to our right. A comparatively large valley or gorge seems to come from it and to go to the lake. The watercourse of another valley from the range, the base of which we followed on soft undulated hilly ground, had, at its left side, an erosion terrace 4 or 5 m. high. Protected by it, two sheepfolds had been built of stone, and much sheep-dung was left in them. Higher up there was a place for gold-digging; its name was later on said to be *Selung* (or perhaps *Serlung*). We leave them, to cross two very tiring hill-slopes. One has to ride up to their tops and then down into deep valleys between them. They consist of fine dust covered with grass and their soil is pierced by millions of rabbits' holes. The ponies are sinking in them at every three or four

paces; it is as if the whole ground were rotten. South of the second protuberance, *Camp LX* was pitched in a deep valley where the height was only 4,843 m., even lower than *Chuta* 61 marching days ago, and nearly the same height as *Mont Blanc* (4,810 m.).

Some distance above our camp, there was a Tibetan camp, the two owners of which payed us a visit and gave some information. The names mentioned by the woman the day before proved to be correct. The mountain range to the east of our route for the last two days, was called *Tsang-tsa-kang*. They were from *Gertse*, a place to which they reckoned 15 or 16 days; from *Gertse* they reckoned 25 days to *Gartok*, and 22 days to *Tok-jalung*. These Tibetans had 5 yaks for sale, and some goats, the milk of which was an important part of their nourishment. Their principal livelihood is hunting. When they have camped at a new place, where the grass is good and sufficient for their yaks, sheep, goats and ponies, they are sure very soon to kill a wild yak and are then occupied for some days to prepare it, and have food for many days. If the game gets shy and leaves the place, they wander to another hunting ground — the country is big enough and the hunters are few, as we have seen. The wild yak's dung is collected by the women and children, and a fire is always burning in the tent. The Tibetans sold us 5 yaks, 4 sheep and 8 goats, some fat and milk, and thus saved us from a rather critical situation.

The two Tibetans agreed to accompany us some days' march, which was a good help both in finding the road and getting the correct geographical names. Before leaving *Camp LX* they gave us four names more in the vicinity *viz.*, a small snowy peak to the N. 89° E., *Mayu-gangri*, some not very high yellow hills to the N. E., *Kuge-jani*, the plain east of the camp and south of the lake, *Kuge-kemar*, and a red mountain north of the lake, *Sa-moma-sakche*, not entered on my map. On the latter, Pl. 5, there is a *Tsantsa-kang*, which should rather be written *Tsang-tsa-kang*, which is the continuation of the range north of the lake as shown on Pl. 4<sup>1</sup>.

On *November 14th* more than two thirds of the march take us S. E., the rest, S. W. The distance is 14 km., and the ground again rises 107 m. or to 4,950 m., which is the height of *Camp LXI*. The rate of the ascent is, therefore, as 1:131. This day and the day before we had no wind worth mentioning; the minimum temperature had been —27.1°, proving that the temperature is independent of the wind.

To our right we have a series of rounded hills from which several small and a few considerable watercourses come down, all filled with gravel and perfectly dry. In one of them, called *Gomo-kelung*, the sand of its brook was auriferous and it used,

<sup>1</sup> On Pl. 5 there is a red P indicating a panorama sketched at *Camp LX, Gomo*. This is, however, missing in the panoramic atlas. In a very few cases I have forgotten to indicate, on my original sketch, where the panorama was drawn. Such panoramas have, of course, been excluded.

as the other places before mentioned, to be visited by gold-diggers every summer. After seasons of comparatively large gain, the number of visitors used to increase. After years when the sand only yielded a small amount of gold grains, only a few diggers returned. Our road approaches the hills, and at the point where our direction becomes southerly, solid rock at last cropped out of the detritus and proved to be light grey quartzitic sandstone. No other living rock was passed the whole day. Turning around the base of the hills we finally direct our steps to the S. W., crossing some watercourses which all, no doubt, by and by join one principal bed directed to *Gomo-tsaka*. The last bed contained ice and some running water, and near it *Camp LXI* was pitched.

The names given us during the march were the following: *Shemar-tibo*, a mount at some 15 km. E. S. E., and *Tseka-guwa*, hills to the S. E. The same name was said also to indicate the valley leading up to *Camp LXII*, and farther S. E. *Seo-yunna*, a meridional range farther south with some snow. The snowy mountain *Mayu-gangri*, was still in sight at a considerable distance E. N. E. Behind the hills south of the camp and to the S. W. of it, there was said to be a region called *Gomo-gakcho*, where gold was to be found. All the names here mentioned, except the last, are to be found on Pan. 71B, Tab. 11. We see here the mountains N. W., north and N. E. of the camp. The corner to the N. 54° E. is the one at which our direction became S. W.<sup>1</sup> To the N. 83° E. the snowy peak of *Mayu-gangri* is seen rising above the plateau-land. The pyramidal, but not very high, peak, *Shemar-tibo*, rises to the S. 69° E. To the S. 45° E. is *Tseka-guwa* which is rather a region than a mountain. To the S. 15° E. a part of the snow-covered *Seo-yunna* is in sight, and would later on be approached by our route.

Regarding the names in such a region as this it is, of course, difficult to tell whether they are absolutely reliable or not. I have said before that we, regarding the first names given us, could check the veracity of the three natives we had met so far, for they gave, independent of each other, the same names. But now, during the few days' march when we only had the two Tibetan guides to ask, it was difficult to check the veracity of their information. I used to have the younger man with me. He was about 30 years old. My caravan-bashi, Mohammed Isa, used to question the older man, who was about 50 years of age. In camp we compared

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<sup>1</sup> The hills to the right of this corner are situated on the other or eastern side of the plain, *Kuge-kemar*, south of *Gomo-tsaka*. My map-drawer, Lieutenant Kjellström, has been conscientious enough not to enter it from the panorama to the map. Here again is an example of how the panoramas complete and fill up the map. The bearings on the map are not always quite in accordance with those of the panoramas. This is due to the fact that my field-map has been forced into the net of co-ordinates and into accordance with the points fixed by the Survey of India and British exploration in general. In cases of disagreement the bearings of the panoramas are more reliable, since no force had been laid upon them.



THE FIRST TIBETANS, CAMP 60.







CAMP 60.





PUNISUK AND TSERING DAVA, OUR FIRST TIBETIANS, CAMP 60.



THE ISOLATED PEAK TO THE N 60° W FROM CAMP 80. (CP. PANORAMA 93. A.)



notes. I have no reason to believe that the two Tibetans gave us false names, as they proved to be perfectly honest in everything else. But another question is in how far the names mentioned to us were *commune bonum* of all Tibetan hunters, nomads and gold-diggers who used to visit these regions. For one could imagine that a certain tribe or even family of *Gertse* that every winter perhaps since generations back, visit a special region of this inhospitable plateau-land to hunt, invent their own private significations or denominations for such geographical objects that are familiar only to them. The same objects may be called by other names if visited by other families or tribes. Such cases may happen only with such parts of the northern *Chang-tang* which only occasionally are visited by a few families of hunters or gold-diggers, for the professional hunters, as a rule, wander farther north than the pure nomads. However, I feel inclined to believe that the northern-most names one comes across, may be accepted as real general names, not only as ephemic denominations. From the very origin, perhaps several hundred years ago, they may have been given by hunters who felt the necessity of having a means of fixing the situation of a certain place. If they called a certain valley, where wild yaks used to be numerous, *Lungnak* or the *Black Valley*, they had a means of pointing out this very place to their comrades. The woman we met at *Lungnak* told us that her parents would soon arrive from *Gertse*. If they did not know where *Lungnak* was they would, of course, never be able to find her black tent. And certainly they also had to know that it was the *Lungnak* of *Gomo-tsaka*, for we may be sure there are several »Black Valleys» in these parts of Tibet. Once the name thus originally became fixed, it remained through centuries and will nevermore disappear. It is, therefore, likely that these names are very old. By and by they will be heard of and accepted by all those people who at all visit these regions, whether hunters, nomads or gold-diggers.

The distinctions between hunters and nomads are not always great. Thus, for example, our first two Tibetans had 100 sheep and goats together and could very well exist even if they found no game. But they find game and spare their flocks. The gold-diggers on the other hand, are usually more adventurous people without a well arranged livelihood and come from greater distances. But they will always meet hunters and nomads and soon become familiar with the geographical names. It is beyond doubt that the few names given to me from the region around *Gomo-tsaka* are not the only ones existing there. They are only such as indicate larger and more prominent objects in sight. The Tibetans probably thought it sufficient to give us only the names of objects easy to point out, as the lake, one or two valleys and some high peaks. But if we had followed them in other directions across the district, they would certainly have remembered some other names well-known to them. The farther we proceed to the south, the surer we may feel that

the names are correct, for in regions where the tents were not quite so rare as here, we had more opportunities to check the information given. Names, as for example *Teri-nam-tso* or *Kanchung-gangri*, are as definite as Ladoga or Ural. It is, therefore, only in the seldom visited districts to the north that sometimes involuntary mistakes can be made. Before leaving the question of names I will only add that I have written them phonetically, exactly as I heard them pronounced by the Tibetans. The spelling has then been controlled and in many cases corrected by Professor K. V. Zetterstéen of Uppsala.

On *November 15th* our route is 10.3 km. S. E. and S. S. E. The ground rises 88 m.; as *Camp LXII* is at 5,038 m., the rate is as 1:117.

For three days we had no wind worth mentioning, which had a very favourable influence upon the caravan in so far that no animals were lost. The assistance which they got from our 5 yaks, also contributed to the good condition of our ponies and mules.

We follow the eastern base of the hills at the other side of which *Gomo-gakcho* is situated. A valley coming from them was called *Chakyam-ningra*, in the background of which, a part of mount *Seo-yunna* is situated. Along this valley a road was said to go to a pass and beyond it to continue S. S. E. To our left is still the plain of *Kuge-kemar*, where long lines of black stones were erected by the hunters; an antelope never crosses such a line, but follows it and thus is led to the trap where it is caught.

The plain comes to an end and we slowly enter the valley which comes from *Tseka-guwa* and has the same name as this mount. We are again on a well-trodden and worn road along the sides of which at several places the traces of Tibetan camps were to be seen. There is good grass, softer than hitherto. The ground is fine dust; at some places gravel had fallen down from the side rocks, though hard rock is rare. It consists of grey schistose clasto-phyrlic quartzite. A ribbon of ice 2 or 3 m. broad occupies the lowest part of the bed, and ice is seen in some small side valleys as well. Antelopes are grazing on the open plains of this fairly broad valley. In the surroundings of *Camp LXII* several herds of kyangs were seen, some 8 wild yaks and then again some antelopes in small flocks. The camp was placed at the lee side of a ridge which may be regarded as the northern continuation of *Seo-yunna*. At this place the brook of the valley looked more considerable than it is, on account of the extensive ice-sheets in its bed, but open water was still to be had. The valley of *Camp LXII* is a flat trough, to which small water-courses gather from the south, S. E. and east. Pan. 69, Tab. 11, shows the view so far as it is open. To the S. 40° E. mount *Tseka-guwa* rises, and to the S. 7° W. is the highest peak of *Seo-yunna*, which from here looked like a dark bulky mountain, not very high, and with a few patches of snow, probably eternal.

On *November 16th* our route goes 13 km. S. S. E. *Camp LXIII* is at a height of 5,211 m. or 173 m. above *Camp LXII*, giving a rise of the ground as 1:75.

The weather still remained favourable after a minimum temperature of  $-25.9^{\circ}$ . The road slowly ascends up through the flat and open valley along the base of hills which everywhere consist of soft material, sand and dust, and are covered with grass. Many fireplaces are passed; the region is so favourable that one may camp anywhere. Now, however, there was no water and no ice in the valley until we reached *Camp LXIII*. The valley is bordered by mountains of very moderate height, all of them with soft rounded slopes. At some places yaks and kyangs are seen. Obviously these animals avoid the cold northern regions in winter and move to the central parts of the highlands. In summer there is a brook of running water, as could easily be seen from the bed winding in the valley. During several kilometers we left it to the east of our route. At about the first third of the march we passed a little spur of living rock, being a dirty greyish chloritic mass impossible to identify on account of its advanced state of decay.

The only names mentioned during this day were: *Tarik-gangri* visible S.  $80^{\circ}$  W. from *Camp LXII* and, farther west, or S.  $89^{\circ}$  W. from the same camp, *Dsengosam*, both of them with some snow on the top, probably perennial. *Kang-lemär* was said to be the name of that part of *Mayu-gangri* from which a glacier originated from eternal snow fields; though this is rather a general signification than a *nomen proprium*. In the course of the day's march the partly snow-covered *Scoyunna* unfolded its details to our right.

During the marches and at camp, our two Tibetans, Putsuk and Tsering Dava, gave us some proofs of their geographical knowledge of their country. Though it is, of course, impossible to fix the position of the objects given, it may still be of some value to save the mere names from oblivion. Fourteen days to the S. W., in the district of *Horchan*, the following mines were reported as being situated: *Yachen*, gold and copper, *Lung-marö*, gold and copper, *Mullbeh*, silver and copper, *Nipsukungka*, gold, silver and copper.

As the two men accompanied us only to *Camp LXIV*, it might be interesting to mention the names of the places at which we, according to their proposed itinerary, ought to pass the nights. For natives knowing their whereabouts everywhere in this intricate labyrinth of mountains and valleys, it is easy to say: at that and that place you have to pitch your camp. But to foreigners, who are the first in the region, it is very difficult to follow the march-route proposed. We had told them we were bound for *Bogtsang-tsangpo*, and so far as they knew the road, they gave us the names. It is easy to understand that we, without guides, could not possibly camp at the places proposed by the Tibetans. For we always camped

where grass, water and fuel were to be had, disregarding the length of our marches. The names given by the Tibetans might be situated between our camps and have been lost to us as nobody was there to tell us of them. On the other hand we really seem to have entered the very road proposed, for at least some names agreed with the list given. The latter runs as follows: Beginning from *Camp LXII*, they reckoned our march to: 1. *Seo-yunna*,<sup>1</sup> or *Camp LXIII*. 2. *Radu-tsäka*, a valley with water, obviously not the same as our *Camp LXIV*. 3. *Ngemba-dungtsa*, a little lake surrounded by high mountains, and quite in accordance with our *Camp LXV*, as will be seen hereafter. 4. A plain without a special name. 5. *Chupcha-karne*, a valley with water and grazing-grounds, where one is passing between black mountains, some of them with snow. This place is naturally the same as our *Camp LXVII*, where the name *Chupcha-karmo-lungpa* later on was given us. 6. *Kung-rergen*, with water and grazing and a little lake to the south. This place could not be identified. 7. *Kungdo-lema-karmo*, the region south of the above-mentioned lake; not identified. 8. *Puyung-sokpa-dre*, a narrow valley where everything necessary is to be had. The name could not be found by us. 9. *Mukpo-serkung*, a large valley with a considerable brook running to a little lake called *Mukpo-dimrap*. 10. *Mukpo-dungnik*, two valleys the brooks of which join. 11. *Namdäng*, a place where everything is plentiful, and in the neighbourhood of which there used to be several tents from *Naktson*. From this place a large black mount with ice and snow was said to be visible. Only so far did they know the road, which, from *Namdäng* ought to take 4 or 5 days more to reach *Bogtsang-tsangpo*. The three names with *Mukpo* as their first component, put it beyond doubt that we really were able to follow the way proposed. For we passed, between *Camps LXXII* and *LXXIII*, a *Mukpo-malung* and at *Camp LXXV* a *Mogbo-dimrap*, which of course is identical with the *Mukpo-dimrap* of our Tibetans, though the pronunciation we later on heard was more soft; but this is only a matter of dialects, and *mukpo* and *mogbo* are one and the same word. The Tibetans had thus told us we had 15 or 16 days to *Bogtsang-tsangpo*. In reality we had 18 from *Camp LXII*. At any rate we had obtained a control on the reliability of the Tibetans, and it may well be said that they proved to be quite trustworthy. For certainly they were not responsible for our not finding several of the names they had mentioned to us. After having checked their veracity in this way, the other information they gave us increased in value.

Our route as described above was said to run a three days' march east of *Tok-aurakpa*. The road from *Camp LXII* to the home of our two Tibetans in the district of *Gertse*, was described as passing the following stations: 1. A nameless

<sup>1</sup> According to the pronunciation this name should, in German, be spelled *Se-u-jünna*.



valley. 2. *Dsana*, a stony valley. 3. *Rungma*, a favourable valley with water, grazing and fuel. 4. *Dugü-yupcha*, a mountain with a little lake at its base. 5. *Rase-ruva*, a valley. 6. *Rango-yü*, a valley. 7. *Gepu-marö*, a large fresh-water lake. 8. *Song-ringmo*, a valley. 9. *Targo-dong-tso*, a little lake. 10. *Gyengdeng-sherma*, a valley. 11. *Targo-charuk*, a valley with high, black mountains. 12. *Tsekamari*, a little valley with water. 13. *Tarngo-pakchen*, a place where several small valleys join to form a large one. 14. *Sogna*, a place with gold sand. 15. *Tarngo-üja*, a little lake. 16. *Jungtsong*, a district. 17. *Ngarung*, a considerable brook situated in the district of *Gertse*, where our two Tibetans have their tents in summer. From *Gertse* they reckoned an 8 days' march eastwards to *Tok-daurakpa*. They had never been in *Lhasa* or *Tashi-lunpo*, but Tsering Dava had made the pilgrimage to *Tso-rinpoche* or *Manasarovar*. Beginning from *Ngarung*, in *Gertse*, he gave the itinerary as follows:

1. *Chapcha*, a valley with a little water between black mountains. 2. *Lärring*, a large brook running westwards. 3. *Ra-mombo*, a place with several ruins. 4. *Ngang-tsang*, a fresh-water lake. 5. *Ngomo*, a valley with water. 6. *Kungra*, a valley with water. 7. *Tarap*, a large fresh-water lake. 8. *Oma-tso*, a smaller fresh-water lake. 9. *Jigung*, a little lake surrounded by mountains. 10. *Ombo-tong-yung*, a little fresh-water lake with bush vegetation. 11. *Sertsuk*, a large valley with a river and with a large lake to the north called *Yüshüp-tso*. 12. *Pamo*, large valley with a river. 13. *Paktuk-mombo*, a valley with the same river as under 12. 14. *Bushikungka*, a small pass. 15. *Go* (or *Gok*), a valley with a rivulet. 16. *Nicmo-chosek*, a valley with water. 17. *Mugo-gunkor*, a large valley with a little lake. 18. *Mugotillep*, a small lake. 19. *Mugo-ngomo*, a valley with water. 20. *Aburr*, a valley with water. 21. *Tüsa-namgo*, water in a valley. Here the road divides into two branches, of which the left or eastern one continues *viâ*: 22. *Dam-karchen*, a valley, 23. *Sang-nakchä*, a plain. 24. *Lamo-latse*, a little pass. 25. *Shang-tse-go*, a place on the mountains, from which the Sacred Lake first becomes visible and where it is greeted in a religious and ceremonious way. 26. *Yama-chokcho*, a valley. 27. *Lungtep*, where the road first comes into contact with the *Indus*. 28. *Hom-chucher*, a place with a large river that joins the *Indus*. 29. *Hle-la*, a small pass. 30. *Tso-movam* or *Tso-rinpoche*, the Sacred Lake. This road is difficult to identify by the help of our existing maps as most of it goes through unknown country. It starts in the region where Nain Sing, Littledale and I have passed, and is directed W. S. W. to the course of the *Indus*, being the same road as the one I followed in September, 1907. It must pass very near the district of *Yumba-matsen* (Pl. 13). Its 17th station, *Mugo-gunkor*, is obviously the same as my *Mugum-gomkor*, though I am not in a position to say which of the two spellings is most correct. No. 21, *Tüsa-namgo*, is certainly the brook, *Tuse-chu*, passing near my *Camp CCXXXVIII*.

My investigations (Pl. 12) did not reach sufficiently far west to tell where *Tuse-chu* went to. It may be that another road than the one I followed in September, 1907, and situated west of this touches *Tuse-chu* farther north or N. E. from the point where I crossed the rivulet. For, otherwise, it is difficult to say why No. 22, *Dam-karchen*, should have been mentioned *after Tuse-chu*. The name *Dam-karchen* is exactly the same on my map Pl. 12. On the other hand, No. 20, *Mburr*, is mentioned as being passed two days before *Dam-karchen*, though it is not even half a day. On my map *Mburr* is spelled Burr as I heard it on the spot. No. 23, *Sang-nakchä*, is probably the same as *Sonakya* on my map. No. 24, *Lamo-latse*, is my *Lamo-latse-la*. South of it No. 25, *Shang-tse-go*, is the same as my *Shantse-gau*; no doubt the mountain has to be ascended to its very top to get a view of the Sacred Lake. No. 26, *Yama-chokcho*, is the same as *Yama-koto* on Pl. 12, and *Lungtep* on the *Indus* is somewhere below *Singi-kabab*, the source of the *Indus*, perhaps near *Lung-korlo*, Pl. 12. The last two places before the Sacred Lake, I cannot identify. The latter was called *Tso-movam* and not *Tso-mavang* as is more common on the shores of the lake.

Regarding the road from *Gertse* to *Tok-aurakpa*, a place known since Nain Sing's memorable journey, our Tibetans mentioned the following names: 1. *Ajo-jeva*, a valley. 2. *Chagrek*, a valley. 3. *Rungun-yung*, a valley. 4. *Rdungkung*, a valley. 5. *Tashi-tso-buk*, a small lake. 6. *Rakchen*, a valley. 7. *Tyok-tugu-rakba*, which was their way of pronouncing Nain Sing's *Tok-aurakpa*. Beyond the last-mentioned place they had only heard the Name *Nalep* which is to be found on Nain Sing's map. Of other names on the Pundit's map, they had heard *Tsering-golip*, *Kolang*, Nain Sing's *Golang*, *Dongsang-chu* and *Shechö*, a river. *Tong-tso-tsaka* was said to be a big lake whilst *Tashi-tso-buk* was a small one. The latter is called *Tashi-bup-tso* by the Pundit and is by him considered larger than the *Tong-tso-tsaka*. Nain Sing may of course be right.

From the region of our *Camp LXII*, the road to *Tok-jalung* was said to pass through the following places: 1. *Ngurva*, a valley. 2. *Shatok-sharnup*, a place where two valleys meet and gold is found. 3. *Serinsam*, a valley. 4. *Yurke-memba*, a valley. 5. *Ngonyung*, a valley. 6. *Hurtu*, a valley with a brook. 7. *Ngochen*, a valley. 8. *Paktuk*, a valley. 9. *Mande*, a valley. 10. *Yüshüp-tso*, a lake, obviously the one that was mentioned as being situated to the north of *Sertsuk* on the road from *Ngarung* to the Sacred Lake (see above). 11. *Luma-ringmo*, a salt lake, no doubt the one I passed on November 3, 1901, and which then was said to be called *Luma-ring-tso*. 12. *Yontäng-nakpo*, a salt lake. 13. *Karpo-geble*, a salt lake. 14. *Kachen*, a salt lake. 15. *Tute*, a salt lake, at which the road divides in two branches, the left or southern one continuing to: 16. *Ka-serne*, a valley. 17. *Chine-rung*, a dry valley. 18. *Chüdü-marya*, where to the left a lake is situated

that has two names: *Nirgen-tso* or *Kogon-tso*. 19. *Shalung-sharma*, a valley. 20. *Tok-jalung*, or, *Chok-jalung*, as they pronounced this name.

From *Tok-jalung* a road was said to proceed to the *Indus* by: 1. *Kunnö-lungche*, a valley. 2. *Nara-mikchen*, a valley. 3. *Sampuk-sando*, a brook. 4. *Singi-sangbo*, or rather *Singi-tsangpo*, the *Indus*.

Our two Tibetans assured us that the names mentioned were the only ones they knew, though it is more likely that men of their age knew many hundreds of names, as every valley in the regions where they are accustomed to wander about has its own name. Though, of course, it is easier to remember the names when travelling along the road, than to keep them in memory also at a distance.

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## CHAPTER VIII.

### THROUGH MERIDIONAL VALLEYS.

On *November 17th* we travelled 12.2 km. S. S. E. crossing the pass *Chakchom-la* at a height of 5,433 m. From *Camp LXIII* where the height is 5,211 m., we, therefore, rise 222 m. to the pass, which, in a distance of 7.2 km., is as 1:32. On the southern side we had 5 km. to *Camp LXIV*, where the height is 5,042 m. The fall is thus 391 m. and the rate of the slope as 1:13 which is unusually steep. The steepness is here nearly thrice as great as on the northern side.

On the night of the 17th of November the temperature went down to  $-30.4^{\circ}$ . During the day there was no wind, but at 7 o'clock p. m. a N. W. storm blew down with the greatest violence and continued until midnight, after which there was no wind at all. On this occasion again it was interesting to see how masses of sand and dust, tussock-grass and even small stones were blown against and into the tent, covering everything in its interior. And this is only one little point on the immense highlands! It is easy, then, to imagine how enormous the masses of solid material must be that are transported by one single storm. And the transport goes on, as in this case, uninterruptedly for 7 hours. But we had experienced storms continuing for several days and nights, and the next winter I had storms going on for weeks. The quantities of solid material that change place under such conditions must indeed be enormous. They are not carried away to form accumulations somewhere, as for example the loess of Northern China or the sand deserts of Eastern Turkestan. For at another season other winds are prevailing and moving them back again. A large percentage of the flying material gets bound on the way and contributes to fill up the lowest parts of basins and lakes. The mountains being most exposed to the winds become lower under the influence of this continual corrosion, whilst the depressions slowly get filled. In this way the relative altitude decreases constantly, and the character of a plateau-land becomes more and more pronounced. If one has lived a few years in the midst of these killing storms one finds their result, the present relief of the Tibetan plateau-land, the most natural in the world.

To begin with, the ascent up through the valley was gradual; the landscape opens up like an arena or a flat trough, which is joined by several tributary valleys from east and west. These valleys are also broad and shallow. To our right we have a little lake one or two km. long, frozen all over and seeming to be rather shallow. Its name is *Chakchom-tso*. Wild yaks were very common in this high valley; on the slopes of the *Seo-yunna* Range a herd of some 80 or 90 individuals was grazing. The grass was good in this region. Our Tibetans assured us that the grass was better here than in the district of *Gertse*, though the latter is farther south and not quite so high. Flocks of sheep brought hither from *Gertse* become fat. That is also the reason why some 40 or 50 tents from *Gertse* visit this region of *Chang-tang* every year. Some of them, for instance our two Tibetans, remain here six months. They had arrived 19 days ago.

The ascent to the pass in front of us increases, but is never steep. We behold one saddle or protuberance after another to the south and every time one hopes that it is the pass. But there is always a new saddle rising behind it. Finally we are on the top of *Chakchom-la*, and have thus reached one of the highest passes we so far had crossed. There is a cairn built up of small granite blocks. The view to the south is very far-reaching. In this direction the country seems to be rather accentuated, a labyrinth of yellow, reddish and black ranges and groups without visible plains between. Only to the S. S. E. and at a distance of 10 km., there is a little depression the center of which is occupied by lake *Dungtsa-tso*, said to be fresh and now completely frozen over. Still one gets the impression that the country south of the pass is generally somewhat lower than to the north, as later on proved to be the case.

At the height of 5,433 m., at  $-10^{\circ}$  and with a strong S. W. wind, Panorama 70A and 70B, Tab. 11, was sketched. Beginning from the west we see only a little foreshortened part of the *Seo-yunna* Range, which regarded from the considerable height of the pass, seems to be rather insignificant, and not very much higher than the pass itself. Most of it is hidden by the pass-range, and above the northern continuation of the *Seo-yunna* Range we see a flat peak to the N.  $44^{\circ}$  W., belonging to the mountainous tract that has the same name as the lake, viz., *Gomo*. On this *Gomo* Peak there is a little snow. To the N.  $13^{\circ}$  W. at the horizon is still visible a last glimpse of the mighty snow cupola which had been in sight for about two weeks — we could be pretty certain that we saw the last of it now. Its name is *Tsang-tsa-kang* as mentioned above, and as entered on Pl. 4. To the N. E. and east the distant view is hidden by the heights in our immediate vicinity, belonging to the range on which we are standing. The blackish mountain group to the S. E. is *Ngemba-dungtsa*. A black mountain to the S.  $10^{\circ}$  E. is called *Chipcha-karmo*, and is situated quite near and west of *Camp LXV*. To the right or west

of it is an insignificant depression called *Chipcha-nangmo*. Our Tibetans told us that a summer road is crossing this region, which, however, on account of the scarcity of water, is never visited in the winter. The hills immediately south of the pass are called *Chakchom-marö*. At a greater distance in the same direction, there is a region called *Singdo-pungmar*. A depression to the S. S. W., not far away, was called *Taka-marmo*. To the S. 11° W., there is a comparatively high mount called *Singdo-rene*. To the W. S. W., there are hills of a yellow colour, said to be known under the name of *Raddu-tseka*.

*Dungtsa-tso* with its surrounding mountains presents a fascinating picture. Between S. 37° E. and S. 17° E. it is visible on the panorama. The slope down from the pass on its southern side is unusually steep, so much so that one prefers to walk on foot. Such steep gradients are rare in this flat plateau-land and met with only at the sides of high passes. All the way up the soil is perfectly rotten from rabbits' holes. The descent afterwards becomes more gradual, and we cross rounded undulations and protuberances of the ground between shallow, dry water-courses. In the open parts of this trough, kyangs were grazing. Finally we have to traverse a little ridge, rather steep and taking one hour to cross. At its southern side there is a valley with a brook going to the *Dungtsa-tso*. *Camp LXIV* was pitched at the left side of this brook which is fed from springs. The grass was very good all around. Our Tibetans said that such good grass would not be found anywhere on our road to *Bogtsang-tsangpo*, and they advised us to spend a day here, especially for the sake of the yaks. They showed us where we had to march the next day between *Ngemba-dungtsa* and *Chipcha-karmo*, where the country seemed to be fairly open.

The next day's march, on *November 19th*, took us 10.3 km. to the S. S. E., whilst the ground sloped from 5,042 to 4,914 m., or 128 m., being the same as 1:80. It may seem surprising that I contented myself with such short marches, but the reason was the enormous absolute altitude, which is fatiguing both for men and animals, and which makes it necessary to spare the forces of the latter so far as possible. And, after all, the principal thing on such a journey straight across Tibet is not simply to cross it as quickly as possible, but to get acquainted with and see as much as possible of the country and to insure its success by slow marches. I even regard it as a great advantage to pitch my camps rather near to each other. The greater the number of camps is on a diagonal crossing, the greater becomes the number of absolute altitudes determined, meteorological and other observations and of panoramas. One gets an opportunity to digest more thoroughly all the extraordinary impressions and experiences one meets on the journey, and the general result becomes more full and rich.

From *Camp LXIV* we cross the ice-band from the springs and follow the foot of the western hills in a south-easterly direction, having the northern shore-plain of

*Dungtsa-tso* to our left. Near the lake there were many granite boulders at the foot of the hills. The lake was quite frozen over, the ice beautiful, partly transparent, partly white from air-bubbles, and too thick to let us examine the quality of the water, which, however, no doubt was fresh as the Tibetans had told us. Hares, rabbits, ravens and some small birds were seen, but no big game. The height is 4,973 m. We follow the shore first to the S. W., then to the S. E. and ascend a little pass some 50 m. above the lake from the southern side of which a little valley goes to the south; in its lower part there are ice-sheets. On the hills at its sides were seen two flocks of sheep, 22 ponies and a number of yaks, as well as one black tent. Lower down in the valley near our *Camp LXV* were 5 Tibetan tents and several sheepfolds of stone with their convexities turned up the valley to the north. Just S. E. of the camp there is a little salt lake, from which the Tibetans of the region fetch their necessary provision of salt. At its northern shore large flocks of sheep were seen and many yaks. At no great distance from the latter some 80 kyangs were grazing. At the western shore, there was a fine fresh-water spring.

The Tibetans of this place had arrived 10 days ago and were natives from *Gertse*. They intended to stay here for about three months; after which lapse of time they wander hither and thither in valleys where the grazing is good. In the beginning of summer they return to *Gertse*. Their six tents were said to have 40 inhabitants in all. They possessed about 1,000 sheep, 60 yaks and 40 ponies together and, therefore, were comparatively well off. They were rather to be regarded as shepherds than as hunters, though, of course, they hunt occasionally.

The geographical names we got from our first Tibetans now proved to be correct. The mountains to the east thus were said to be called *Ngemba-dungtsa*, and the mass to the west *Chipcha-karmo*, though this name now was pronounced like *Chupcha-karna*. Regarding the small lakes, there was a difference in the informations we had obtained, for the Tibetans of *Camp LXV* said that the little salt lake was the *Dungtsa-tso* proper. It may be that this version is the more correct one, for one could see around the white shores how the Tibetans had dug out heaps of salt, which is probably taken from here by sheep caravans in summer. The little lake may, therefore, have a certain economic importance, and under such conditions it would seem natural that it had a name of its own. No other geographical names of this place were known to these Tibetans. They reckoned 10 short days' marches to *Bogtsang-tsangpo*, which proves that they are accustomed to make longer marches than we were, for in fact we took 15 days to reach the river. To *Dangra-yum-tso* they reckoned 20 short days. Of the latter lake they gave the curious description that it was divided into two halves with a mount between them; there were said to be four monasteries on its shores.

From the little pass south of the fresh *Dungtsa-tso* Pan. 73, Tab. 11, was drawn, showing the *Ngemba-dungtsa* Mountains to the S. E. and small parts of both lakes. Pan. 75A and 75B, Tab. 12, gives a clear idea of the general habitus both of *Chipcha-karmo* and of *Ngemba-dungtsa* as seen from *Camp LXV*. We see that both are comparatively large, a fact that explains their having geographical names. To the S. E. the same panorama shows the little salt lake *Dungtsa-tso* quite near the camp.

Though *Camp LXV* was at a lower altitude, or 4,914, the minimum temperature in the night went down to  $-32.9^{\circ}$ , but the winter was advancing. On *November 20th* we marched 17.8 km. chiefly S. E., keeping at nearly the same altitude the whole way. *Camp LXVI* was at 4,928 m. or only 14 m. higher than *Camp LXV*. Between the two, there was, however, a little threshold of 4,980 m. separating two small self-contained basins from each other. Our march, to begin with, makes a little turn to the west, avoiding the ice-sheets of the spring and the salt shore-plain of the lake. But after a while we follow the lake itself on ground of sand with some grass. At some places springs are seen around the lake. The water is open and of a fine green colour. Tables, walls and other formations are modelled in the white salt deposits around the lake. In the S. E. prolongation there is a fresh-water pool, probably formed by springs, and frozen hard. On the hills in the neighbourhood were two flocks of kyangs, of 30 and 150 individuals respectively. No yaks or antelopes were seen in this valley. The ground is nearly level to the eye. To our left is a little dry depression. By and by the ground slowly rises to the S. E., as may be seen from the direction of the erosion furrows from the hills. Sometimes there is some grass or the dry, hard plants called *yer-baghri* in Turki, but other places are perfectly barren. Gravel is rare; the soil consists of sand.

The *Ngemba-dungtsa* group comes to an end. On the south it is bounded by a little transverse valley that seems to fall to the N. E. At a short distance in that direction, three tents were said to be pitched. A meridional mountain range of moderate height to the east was called *Keling-tavo-amchuk*, and the whole region there about *Keling*, pronounced nearly like *Kling*. To the east was an isolated peak of conical shape, called *Chea-govo-rachek*. Leaving the little valley to our left, we slowly rise to the threshold of 4,980 m. from which our direction becomes E. N. E., following a dry watercourse. Here the landscape is again completely changed. At the foot of hills which seem to be ramifications from the *Keling* Mountains, is the very small lake of *Pulka-tso* (pronounced *Puka*) and S. E. of it are two pools covered with solid ice. The one at the S. W. shore where *Camp LXVI* was pitched, had open water at two places, obviously from springs in the bottom. A black tent had just arrived from *Gertse* and intended to stay here for three months. The place is called *Ngemba-tokchen*, and in the neighbourhood is a place with gold sand.



A double-peaked red mount to the E. S. E. was called *Kong-rgeng*. An idea of the surrounding landscape is gained from Pan. 72A and 72B, Tab. 11, showing rounded hills of moderate size in all directions. Boulders near the camp consisted of mica-granite as described by Prof. Hennig in Vol. V, p. 30 and Tab. I, 1 and 2. The same specimen is found in living rock on *Chakchom-la*.

On *November 21st* our march was 9.2 km. to the S. S. E. whereby we again had to rise 241 m. or to 5,169 m. which was the height of *Camp LXVII*, meaning the unusually steep rate of 1:38. Crossing the chief bed from the west and leaving two fresh-water pools to our left we cross the slowly rising grass plain to the foot of the southern hills where we ascend a little valley to the S. S. E. The region, especially the plain, is very rich in kyangs which are not in the least shy, and seem to be left alone by the nomads. The rock higher up in the valley is greenstone. The ascent becomes gradually steeper, and the caravan advances very slowly. Finally we reach the culmination, which is rather a flat platform of nearly the same height as *Camp LXVII*, or 5,169 m. Here a short panorama, Nr. 74, Tab. 11, was drawn, showing the range *Keling-tavo-amchuk* to the E. N. E., east and E. S. E. Between us and this range there is a depression or plain, the northern part of which is crossed by the principal erosion bed from the pass and its surroundings; this bed probably runs to a lake somewhere in the N. E. To the N. 72° W. is a mountain called *Tarik-gangri*, which is not the same as the one west of the road between *Camps LXII* and *LXIII*. The latter is shown on the map, Pl. 5, as an isolated peak. This peak is no doubt a more prominent part of a range stretching to the south and being more or less parallel to the *Seo-yunna*. Under such circumstances the name *Tarik-gangri* belongs not only to a peak but to a range which is seen only partly from different points of our route. The snow-mount, *Mayu-gangri*, mentioned above, was still visible, now to the N. 38° E., and *Chea-govo-rachek* to the N. 49° E. In a country like Tibet where the mountains are comparatively low above the surface of the plateau-land, rounded and irregular, it is, as a rule, very difficult to tell how or whether the different groups, masses, ridges and ranges are connected with each other. One must feel satisfied if one can make out the principal orographical features in the neighbourhood of the route.

S. E. of the flat threshold, there were signs of a few abandoned Tibetan camps; and now finally we entered a very well-marked road consisting of some twenty more or less parallel paths in the soft soil. The two Tibetans who now were our guides told us that only one month ago the last gold-diggers from the regions we had left behind us and other places at the sides of our route, had passed by this road. The same road is also used by wandering salt merchants who dig out salt from such lakes as the southern *Dungtsa-tso* of *Camp LXV*, and transport it on sheep to *Shigatse* and *Lhasa*. Three or four thousand sheep and several hundred yaks were

said to be used every year for that purpose along the road we now had reached. The small parallel paths of the road are trodden and worn by these sheep which are accustomed to walking in flocks besides one another.

*Camp LXVII* was pitched at a very shallow erosion bed with ice-sheets, but no water. The name of the place was given as *Chupcha-karmo-lungpa*, which sounds very much like the *Chipcha-karmo* of *Camp LXV*. According to our new Tibetan guides we should now be 9 days from *Bogtsang-tsangpo*, though, as I have said before, the distance proved to take more time for our tired caravan. The 9 days were marked by the following names, which only partly agree with those given before. 1. *Kebe-chungu*, 2. *Goro-lebre* (or *Garo*), 3. *Mukpo-tamchuk*, which may be identical with *Mukpo-malung*, 4. *Shaptuk-rinak*, a low black mountain range, 5. *Ribge*, a mountain in the neighbourhood of which there is a higher mountain called *Mayo-bendeme*, 6. *Niring-tsangpo*, a river with a mount *Mogha-gangri* in its vicinity, 7. *Rungtsang-kema*, a place from which and onwards nomads are met with nearly everywhere, 8. *Chuche-monda*, 9. *Bogtsang-tsangpo*. Some of these names could not be identified on our march, and we were in some cases not able to tell whether the first or the second nomads were right. On the map, I have only entered those names that seem to be beyond dispute, though, of course, there is no absolute certainty that all of them are placed at their right places. I, however, enter here in the text both versions in the hope that the day will come when the uncertain points will be cleared up. Our Tibetans could not tell how far from the source and the mouth of *Bogtsang-tsangpo* the point was situated at which we would reach the river when following the above-mentioned road, they even had not heard that the river flows out into a salt-water lake. If travelling without their flocks of sheep, they reckoned only 6 days to the river. A long way to the S. E. was situated a mountain called *Dongshung-momo-sondama* in the vicinity of which were said to be the headquarters of *Naktson*. One of our guides had once travelled to *Amdo*, touching *Ribge*, *Mogha-gangri*, *Skyang-tarna-tombo*, *Jangcha*, a high mountain, *Nam-tso*, *Dam-la* and *Tong-la*. On the way back he had taken a more northerly road, but remembered only the following places: *Chomore*, *Ibuk-tsaka*, *Tsontsa-gangri*, *Lashung*, *Gomo*, *Yung-mamo-tsatsa*, *Kugi-kema* and *Ngemba-dungtsa*, a road that cannot be identified, though some of the places we had passed are mentioned as being situated on it. If travelling from *Chupcha-karmo-lungpa* or our *Camp LXVII* to their homes in *Gertse*, our Tibetans used to camp at the following places: 1. *Ngemba-tiga*, 2. *Kangro-lene*, 3. *Marcham-tso*, a lake, 4. *Dug-jiptsa*, a lake, 5. *Garang-onyo*, 6. *Rang-ombo*, a mountain, 7. *Kepo*, 8. *Tsa-mirang*, a high mountain, 9. *Taje-tso*, 10. *Sindo-rinak*, a high mountain, 11. *Lema-karmo*, 12. *Kunge-toma*, a lake, 13. *Do-ngombo*, 14. *Chungmo-rene* with the lake *Dung-tso* in its vicinity, 15. *Ama-rolva* which is situated quite close to *Gertse*.

The living rock at *Camp LXVII*, or rather a short distance N. W. of it, was reddish grey quartzite; on the little threshold the rock consisted of white quartzite with much felspar.

On *November 22nd* we had 9.6 km. to *Camp LXVIII* and the direction was S. E. On the march we again descended from 5,167 to 5,003 m. or 164 m., corresponding to a rate of 1:58. The altitudes given show that the surface of the ground on the plateau-land, disregarding the mountain groups and ranges, forms waves reminding one of the long flat rollers of the open sea. It sometimes takes several days to cross such a flat protuberance of the ground.

Another curious phenomenon was that the temperature on the night before the day in question did not sink below  $-18.5^{\circ}$  or a difference of nearly  $14^{\circ}$  from the preceding night. Such changes are local and generally depend upon the clouds.

The country during the day's march is monotonous as we follow the N. E. foot of the same mountain range up and down across slopes and erosion beds. We stick to the great road of gold- and salt-diggers, which on the slopes consists of some 50 paths where the sheeps are accustomed to walking amphitheatrically. From a point about halfway, the mass of *Mayu-gangri* is again visible to the N.  $31^{\circ}$  E., and to the N.  $15-28^{\circ}$  E., at no great distance there is a white depression, perhaps a temporary salt lake, which may contain water after heavy rains. From a little secondary threshold, the road goes steeply down to a valley where jack-daws were very numerous. At a distance of 2 or 3 km. to our left is a small lake depression to which several dry watercourses were directed and which now seemed to contain no water. The lake is situated on a plain with grass still partly green. Kyangs and antelopes were seen at some places and one single wild yak. Ravens and small birds were numerous. In several of the ravines and beds there are fireplaces, showing that water is to be had in summer; now every one of them was dry, not even ice was to be seen, and the only snow in sight was on the top of *Mayu-gangri*. In front of us there is finally a short but very steep range stretching from west to east. Leaving it to our left we turn S. W. and go up into a broad valley, pitching *Camp LXVIII* near a little isolated rock, where there are many old nomads' camps with dung of sheep and tame yaks. A spring had open water which lower down formed ice-sheets. The name of the place is *Kebe-chungu*. The mountains to the S.  $30^{\circ}$  W. were called *Chuchak-nagmo*.

From *Camp LXVIII*, Pan. 77A and 77B, Tab. 12, was taken, showing the accentuated mountains in the neighbourhood. *Keling-tavo-amchuk* is visible to the N.  $48^{\circ}$  E. To the N.  $68^{\circ}$  E., there was a peak they called *Chea-govo-rachek*, indicating either that this name belongs to a mountainous region or that the first information in connection with that name was wrong. The living rock predominating during the day's march was grey, dense limestone which also formed the rocks around the camp.

On *November 23rd* the march goes 12.2 km. S. S. E. The first 3.2 km. took us up to a little pass of 5,103 m., being a rise of 100 m. or as 1:32. From the pass to *Camp LXIX* was 9 km. with a fall of 104 m., or as 1:86, as the camp had a height of 4,999 m. *Camp LXIX* was thus only 4 m. below *Camp LXVIII*.

The temperature again was comparatively high or  $-20.4^{\circ}$  in the night, in connection with a very strong wind. The season was extremely windy and stormy, and it usually blew from the S. W. The sky was clear blue, but the air was full of fine dust, making a distant view impossible. On account of the strong wind, the cold was terrible and the march very hard.

Leaving the little valley and its ice-sheets, we ride up to the S. E. through a tributary valley with two series of rocky teeth to our left called *Kebe*, and a moderate range to our right. It leads up to a little pass, 5,103 m. high, after which the ground is undulating, and the road goes up and down along the hills, crossing several dry watercourses and miniature valleys, often with fireplaces either isolated or in groups. In a deeper erosion bed, the fireplaces were particularly numerous and near it was erected a stone cairn. Several such »*teur*» had been seen previously, indicating the road, and on the pass of 5,103 m. a cairn was also built. The road had now a less worn appearance than hitherto. This may perhaps be due to the configuration of the ground which allows travellers to march anywhere they like. Far to our left we had during the whole day, a plain or large open valley stretching, as the mountain ranges of this region, from north to south, which is exceptional and rather rare in Tibet. For several days, or nearly the whole way to *Bogtsang-tsangpo*, we had very level and open ground with a few exceptions, though our direction was meridional. On the plain there were several broad and shallow erosion furrows appearing as dark or violet belts. Some of them seemed to be a series of temporary pools and swamps now completely dry. To the east, the open valley is bounded by a mountain range of moderate size with two or three protuberances without snow. The whole country is very dry; water, snow and ice being rare everywhere. Since *Gomo-tsaka*, we had seen no lakes worth speaking of. The fact that the road goes on the slopes of the hills instead of following the open plain valley, is due to the scarcity of water lower down. In the winter water is rare both on the plain and in the hills. At *Camp LXIX* there was no water at all, but in a transverse valley in the range farther south, an ice-sheet was seen from where a little provision of ice was brought to camp.

From this camp one could see that the country became lower to the south. The whole country in this direction seemed to roll in waves, three different flat ranges or protuberances being seen one above and beyond the other. Still the general direction of the ranges was nearly N.-S. The S. W. storm increased in the afternoon, making the surrounding mountains more and more diffused. The sky was



THE ENDLESS CHANG-PANG



covered by heavy clouds going very near the earth's surface and hiding the higher parts of the mountains.

Pan. 79, Tab. 12, shows the eastern half of the horizon from *Camp LXIX*. Here we see the continuation of the open valley between S.  $33^{\circ}$  E. and S.  $24^{\circ}$  E. which, at a considerable distance to the S. S. E., is bounded by low mountains.

On *November 24th* our direction is again S. S. E. for 11.8 km. The ground falls 95 m. as *Camp LXX* has a height of 4,904 m.; the slope is, therefore, as 1:124. During the march a little secondary threshold of 4,965 m. is passed. The configuration of the country remains, on the whole, the same as during the two previous marches. The ground is level or slightly undulating and favourable for the caravan. We slowly approach the foot of the comparatively low range of hills which borders the great valley to the west; to the east of the valley the mountains are higher, particularly one part of them, which according to the description given by the last Tibetans, must be *Goro-lebre*. At its foot there is a little depression, the bed of which is brownish red and is now without water; it is the recipient of the water-courses from the neighbouring mountains. On the southern side of the little secondary pass of 4,965 m. the ground slopes down to the upper mouth of a very narrow gorge between steep mountain walls. As ice was to be found here, we camped at the entrance to the gorge, where the grass was rather poor. Fireplaces and dung of sheep were numerous. The farther southwards we advanced the more common became the traces of human visits. During the last few days, since *Camp LXVI*, we had, however, not met any natives, neither hunters nor nomads, and, of course, no gold- and salt-diggers, whose work is impossible during the winter. Many of the gold-diggers are said to be inhabitants of *Lhasa*. It would be of great interest, though still very difficult, to mark on a map the principal comparatively regular wanderings of the Tibetans during the different seasons of the year. The most irregular and, therefore, most difficult to follow would be the wanderings of the hunters. They advance farther north. They wander, as a rule, alone or at the most two or three tents together, and they are more independent of good grazing grounds than the nomads. Some of the latter undertake, as we found, very extensive annual wanderings, coming the whole way from *Gertse* to the regions we have just crossed, and after having passed the winter there again return to *Gertse*. During these journeys they always camp at places where good grass is to be found, and they are never in a hurry. Even the wandering itself is a part of the care they take of their flocks, and sometimes they stop several days at the same place to give their sheep a good rest, which, of course, always is chosen at places where the grass is particularly good. The nomads we had met thus undertake their long wanderings in search of better grass than is to be found at *Gertse*. It was by mere chance that we had met them on our way. But if we had continued farther east in the

same direction as Wellby and Malcolm and then turned to the S. E. or south, we would probably also have come across both hunters and nomads. The annual wanderings between *Gertse* and *Lashung*, *Gomo* and other places on our route are not to be regarded as something extraordinary, for quite similar wanderings are, no doubt, undertaken in other parts of *Chang-tang*. Yet we know very little of them. We really only know a few particular cases which could with certainty be marked on maps. How very interesting it would be to be able to mark all the routes of the wandering nomads on a large-scale map! Only in the future such a map can be drawn. The same may be said of the gold-diggers. But probably their wanderings are very regular. The principal thing for them is to reach their gold mines as quickly as possible. They are less dependent on grazing grounds than the nomads, as they usually have only a few ponies with them, and the Tibetan ponies are, in case of need, nourished with flesh. But so long as we are unable to tell where all the different gold-mines are situated, and which of them are abandoned and which still in use, and from where the professional gold-miners come, we cannot think of a general map showing their yearly wanderings. We were now and would still for a rather long time, or to the southern parts of *Transhimalaya*, travel through parts of Tibet where there is no permanent population, and where the human beings met with were like birds of passage. Still the problem of their wanderings is a most fascinating one, and a map of their annual migrations would give a very clear idea of their conditions of life as well as of the natural capacity of the country.

The march of *November 25th* is interesting in so far as it takes us, in a distance of 12.3 km. to the S. S. E., from a height of 4,904 to 4,706 m. or a fall of 198 m., being the same as 1:62. During the last four days the absolute altitude had thus constantly diminished from 5,167 to 5,103, 4,999, 4,904 and finally 4,706, showing that we had reached an unusually low depression.

The S. W. storm ceased and the temperature again sank: last night to  $-26.8^{\circ}$ . I have said before that the hard winter storms were more trying for the animals than anything else. In the night before and the morning of November 25th, 4 mules died, and only 8 were left. The last storm had been too hard for them. The ponies of *Sanskar* and *Ladak* proved, in the long run, to stand the atrocities of the climate better than the mules. It would be of a certain physiological interest to mark out on a map the places where ponies and mules died, and to enter the date, the absolute altitude, the temperature and the strength of the wind. No doubt such a map would show the relation between the capacity of resistance of the animals and the climatic elements. As a rule the effects of the bad influences, as for instance, lack of grass and water, will be delayed, so that occasionally some animals may die at a comparatively low place with good grass and water and no wind, if they, during the preceding days have had to endure cold, storms and starvation.



But even such circumstances could easily be read from a map containing all necessary information. The yaks we had bought from the nomads saved the situation, and it may be a question of whether the best plan would not be, for a thorough exploration of High Tibet, to use yaks, flesh-eating Tibetan ponies and Tibetan nomads as guides. An expedition of this kind would move very slowly, but it would be nearly independent of the climate and other hardships of the journey.

From *Camp LXX* we proceed S. S. E. through the very narrow, wild and picturesque valley that has cut its gorge through the sometimes nearly perpendicular, limestone rocks. The erosion bed in its bottom is meandering and filled with gravel, but on its sides, the left or the right, there is always space enough for the road, which here is only one single path. The ice of *Camp LXX* soon ceases and no more appears lower down. The rock, grey dense limestone as before, projects from both sides and presents a picturesque scenery of a kind that is rather rare on these great levelled altitudes. Very often fireplaces are passed, which mark the camps of gold-diggers and salt-caravans and other people and date from seasons of the year when water is to be had everywhere in the gorge. The valley opens up gradually and becomes broader; at its right side there are now soft rounded hills, between which a spring was found. At a short distance from there, the country was quite open and we had an excellent view of the region. From a little hill, I sketched Pan. 76A and 76B, Tab. 12. It shows to the N. 24° W. the opening of the narrow valley in which we had come down. To the north and N. E. it shows the mountain group that had separated the first half of the day's march from the great valley we had followed for three days. From E. N. E. to S. E. we see a new lake larger than the previous ones ever since *Gomo-tsaka*. East of the lake bed and the whole way around to S. W. there were moderate, rounded mountains. Already here one got the impression of having a large tectonic valley to the S. E., a valley stretching S. W.—N. E., and joining the large valley we had followed, just at the place where the new lake was situated. To the E. N. E. the country was open and low, and in this direction the new large valley seemed to continue. All the mountains in the neighbourhood were coloured in different red and pink tints. The lake dominates the landscape with its dazzling white surface. Only where the shore was nearest to us, a little bit of open water could be seen. At the shore, terraces and ridges of fine white dust or gypsum were seen. It was easy to see that it was a dying lake of the same kind as I have described in western Tibet, for instance: *Lakor-tso*.

From the observation point we continued down a desiccation terrace, on the slope of which we found a *mani-rigmo* of the kind which are so common in *Ladak*, though only 3 m. in length and 1 m. broad and 0.2 m. high. Most of the stones were round or flat and only a few were slabs of schist. The usual inscription was well and carefully carried out and painted in red and green. It was surprising to

find a *mani-rigmo* here, far away in the wilderness; usually, as for instance in the valleys of the *Transhimalaya*, they indicate the approach to a *gompa* or some other sacred place.

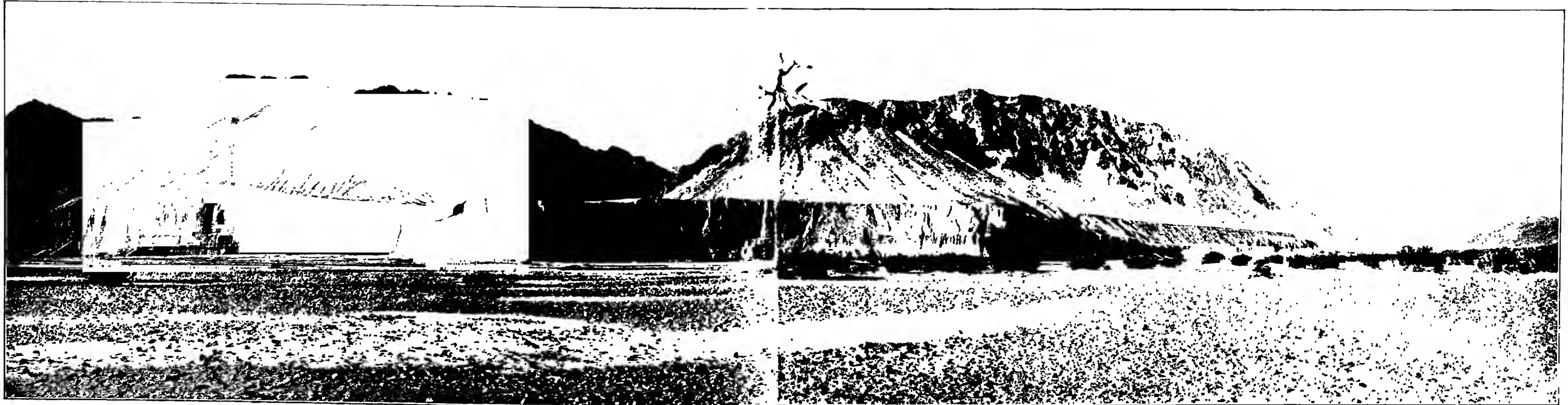
Continuing S. E. at a distance of one or one and a half kilometer from the shore, we slowly descend, crossing some erosion beds to a comparatively large valley with a larger bed which is always dry. The mountains at its southern side send out a little promontory into the lake. At the shore we again see the curiously modelled formations of white deposits of salt and gypsum. Here and there small open pools of water are seen. Just outside the promontory a tepid spring comes up, forming a strip of open, bitterly salt water in the middle of the white deposits. My men said that a little distance from the shore the bed was covered with ice, though I am not sure that it was not all white dry deposits. On the northern slopes of the hills at the southern side of the valley, four distinct terraces were seen, the lowest at about 20 m. above the lake and all at short intervals from one another. The limestone rocks of the place are wild and steep. We crossed them in a low threshold and after passing a transverse valley from the S. 80° W., we had to climb a second, somewhat higher range or ramification, parallel to the first one. This second range also ends with a promontory into the lake, at the base of which, there is also open water. The living rock is everywhere a grey, dense limestone. After crossing a new transverse valley from S. 80° W., the road crossed a third very low threshold of wild rugged cliffs. On these small passes, cairns were built; also three stone pyramids on the one in the middle. The ground is full of gravel. Our direction finally becomes south, between the base of the mountains and the white shore. The southern part of the lake bed is modelled in the most curious way in pyramids, tables, walls, cones and different extraordinary formations with deep furrows between, which all is a work of the winds. Farther out in the bed, one had really the impression of seeing ice. Fresh water could be obtained from several springs. As we had no guides now, I could not determine the name of this interesting place, but it corresponds in every detail with the description I had received from our last Tibetans when they spoke of *Rinek-chutsan* or »The hot water of the black mountain«, so I have entered this name on Pl. 5.<sup>1</sup>

At *Camp LXXI* we were at the lowest point we had passed ever since *Gogra*, on August 28th, or nearly three months before. The height was only 4,706 m., which also signifies the height of the lake. We had obviously left the highest protuberance of the plateau-land behind, and had arrived at regions some 200 or 300 m. lower than the altitudes we were accustomed to. Pan. 78A and 78B, Tab. 12, gives a general aspect of the limestone mountains to the west, N. W., north and N. E.

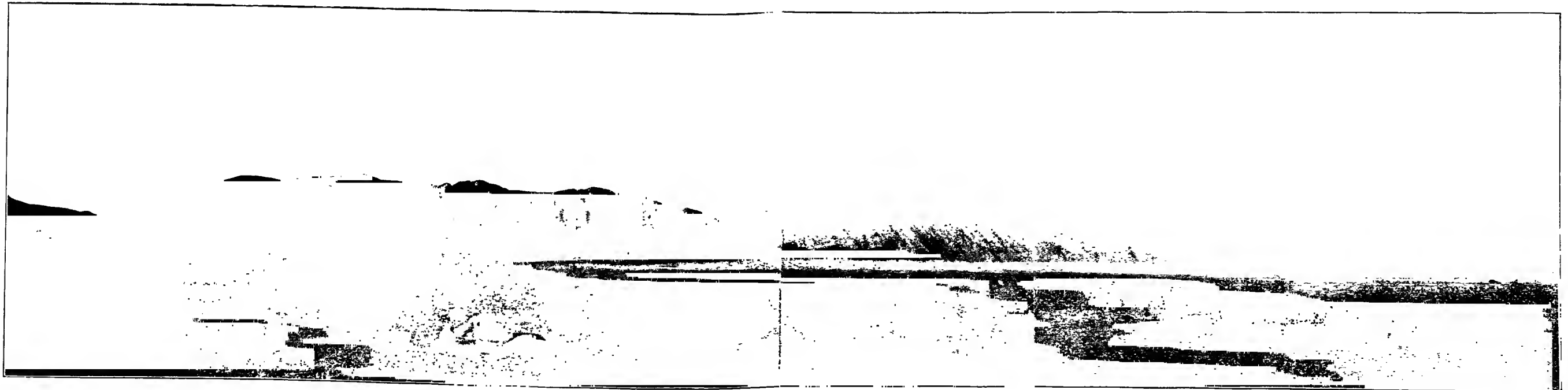
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<sup>1</sup> *Kinek* on the map and on the panorama 75 is of course a misprint for *Rinek*.





TERRACES AT THE RIGHT BANK OF THE CHANG-CHINGHO, AS SEEN FROM PAMSAL. (CP. PANORAMA 7, A).



VIEW TO THE N. E. FROM CAMP 71. (CP. PANORAMA 78, A).

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from *Camp LXXI* and gives an idea of their rocky, rugged forms. To the N. 46° E., the country appears very low; here is the opening of the broad large valley which seems to continue in a north-easterly direction. To the E. N. E., east and S. E. are the more rounded and moderate hills situated on the eastern side of the lake.

All the mountains visible from *Camp LXXI* were of different red nuances, some of them being nearly violet or pink. At sunset these red colours were intensified in an almost fantastic way. They had been red as brick or blood, but when the sun was near the horizon, they appeared like volcanoes with glowing lava. The reflexion from these red mountains even tinted the otherwise snow-white lake to a light pink colour. The more distant mountains to the N. E. showed themselves in a very fine and light colour, but everything in sight was red or pink, a landscape of the most brilliant and fascinating colouring I have ever seen. Above it the sky was as blue as a turquoise. The silence, the absence of life of any kind, gave the impression of a dream rather than of reality. At *Camp LXXI*, on the night to *November 26th*, we had a temperature of  $-33.2^{\circ}$  which was the lowest temperature hitherto. It is curious that this should take place at the lowest point we had camped at, on the *Chang-tang*.

Before leaving *Camp LXXI*, I sent one of my men on a reconnoitring trip across the southern part of the lake. On his return, he reported that the ice-sheets visible here and there from the western shore, were simply formed on pools from springs, of which he had seen eleven. Some of them were salt; others nearly fresh. The rest of the bed was dry and consisted of white salt and gypsum deposits. At *Camp LXXI*, calcareous sinter had formed in the bed of the lake. It would, of course, be most interesting to execute a careful and detailed survey and geological research of such a basin as that of *Rinek-chutsan*. The lake bed and its surrounding mountains should be mapped on a large scale and the desiccation terraces marked out. Such a monographic study of one basin would serve as a prototype of all other formations of the same kind on the *Chang-tang* plateau-land and also give an idea of desiccation. I made an attempt of that kind at *Lakor-tso*<sup>1</sup> in 1901. The difficulties of such an undertaking are, however, great, for usually, one is depending too much on a dying caravan, the endurance of which does not suffice for a longer stay. When reaching such a place as *Rinek-chutsan*, the chief interest of a caravan is to try to save itself until it reaches lower regions. First the pioneer work has to be done. The next stage of scientific exploration will be the detailed research.

On *November 26th*, we proceeded only 4.8 km. S. S. E., rising from 4,706 to 4,819 m. or 113 m., *i. e.* at a rate of 1:42. Already from *Camp LXXI*, we could see that we had to cross a new pass to the south, and decided to approach it a

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<sup>1</sup> Scientific Results, Vol. IV, p. 158 et seq., and Pl. 26.

few kilometers before traversing it. We therefore crossed the plain south of the lake in a straight line. The rise was gradual and comfortable to the foot of the southern hills. A comparatively large erosion furrow from the western mountains was crossed, and later on we followed a dry watercourse from the southern hills. These beds, as well as many others around the lake, carry water at some seasons and very likely the lake bed becomes filled with a very thin sheet of water, which soon evaporates in the autumn. At half an hour's distance from *Camp LXXI*, we crossed an old beach-line of the lake. We entered the valley coming from the next pass in front of us. Its gravelly bed was filled with extensive ice-sheets and some running water, from springs. Here *Camp LXXII* was pitched. Of wild animals, only a few antelopes were seen. Dung of kyangs was common, but no signs of wild yak was to be found. From numerous old fireplaces, one could see that the Tibetans used to pass a night here on their wanderings. At half past ten a. m. the usual S. W. wind began.

Pan. 80, Tab. 13, shows the view to the north from *Camp LXXII*. In the foreground are the last slopes of the hills on both sides of the valley from the pass. Above them a part of the lake is visible and north of it, the mountain group bordering the lake basin at that side.

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## CHAPTER IX.

### TO BOGTSANG-TSANGPO.

On *November 27th* our march goes for 14 km. to the S.S.W. From *Camp LXXII* we had 4.3 km. to the pass *Yumrang-lopchangs*, the absolute altitude of which is 5,032 m., being a rise of 213 m. or as 1:20. From the pass we had 9.7 km. to *Camp LXXIII*, the height of which is 4,753 m., or a descent of 279 m. at a rate of 1:35. These figures indicate the profile of the range we now crossed and which separates two self-contained basins from one another. The two endpoints, *Camp LXXII* and *LXXIII*, have nearly the same height, and the pass is some 300 m. above them. The pass of *Yumrang-lopchangs* is exactly 400 m. lower than *Chakchom-la*. We again were reminded of the fact that we were approaching lower parts of the *Chang-tang*.

From *Camp LXXII* we begin to rise in the valley of the pass. From both sides small tributary valleys enter. In one of them was a track along which some time ago great flocks of sheep and many yaks had been driven. In the valley there were many old fireplaces. There was ice only at one place, but no water. No wild animals were seen. Just south of *Camp LXXII* the rock is grey, dense limestone, after which there is no living rock within reach the whole way across the pass. Only at the mouth of the valley that goes south from the pass, there is again solid rock, consisting of red, fine-grained limestone.

The pass of *Yumrang-lopchangs* is rounded and easy and affords a magnificent view, particularly to the north and N. W. where we behold the country we have just come through. Pan. 87A and 87B, Tab. 14, is taken from the pass. To the N. 6° E. we again see the lake and the mountain group north of it, having nearly the same aspect as on Pan. 80, Tab. 13. To the E. N. E., east and E. S. E. are parts of the range we are just crossing in the pass. Between S. 1° E. and S. 9° W. is the valley that goes down from the pass and which we followed. As regarded from this high standpoint, one gets an excellent general impression of the comparatively low depression we have just left behind and of the picturesque red mountains surrounding it. It is surprising that not the slightest patch of snow is in sight.



The last snow-covered mountains are no longer visible. In this respect these central parts of Tibet are very unlike the eastern regions of the plateau-land I had previously travelled through and where high mountain groups with eternal snow and glaciers are occasionally seen. The view to the south from the pass was not easy to make out; it looked like a series of different ranges stretching east and west, one beyond the other.

On the *Yumrang-lopchangs* Pass, a cairn was erected. The road was quite distinct, though it seemed not to be very much frequented by travellers. In the valley going south from the pass, there are, however, many old and new fireplaces, though there is now not a drop of water nor any ice. At seasons when travellers pass there must be water from springs which become dry in the autumn. The red range of limestone and conglomerate that was called *Mukpo-malung* (or *Mogbo*) by some Tibetans, and has a rather rocky and wild crest, stretches east and west and is pierced by the valley. The latter opens out into a great tectonic valley running N. E.—S. W. Its N. E. part seems to be closed by mostly rounded hills, where only here and there living rock crops out; it forms a self-contained basin or flat depression bounded to the north by the *Mukpo-malung* Range, and to the south by a double range of moderate size. The central part of the depression is occupied by a little salt lake with some open water and surrounded by an extensive bed of calcareous sinter and greenish white deposits, forming a labyrinth of furrows and ridges of the same kind as at *Rinek-chutsan* and reminding one of the *yardangs* of the *Lop* Desert. The lake is oblong from N. 68° E. to S. 68° W. In its N. E. prolongation, there is another little salt pool, also surrounded by the same white bed of deposits. The little lake was called *Loma-yäsung*, and its absolute altitude was 4,713 m. The depression is, therefore, comparatively low and surrounded by mountains on all sides. From the point where the pass valley goes out into the depression, Pan. 84, Tab. 14, was sketched showing the series of mountains and hills bounding the depression to the east; to the S. 27° E. the lake *Loma-yäsung* is visible.

The tectonic valley, the N. E. part of which is formed by this depression, continues S. S. W., but here becomes much narrower and is occupied by the little brook called *Niring-tsangpo*, according to the description previously given by the Tibetans. Between the point where we first reached the brook and the basin of *Loma-yäsung*, there is, obviously, somewhere a flat threshold.

From the foot of *Mukpo-malung* we marched S. S. W. along the base of a series of well-marked and steep hills cut through by several small deep-cut transverse valleys with gravelly beds. At the point where we came nearest to the lake we were about 40 m. above its surface, and could clearly see how all the erosion furrows gathered at the little lake. When our direction becomes S. W. we have to our right a series of small rugged rocks and cliffs consisting of much weathered greyish red quartz-amphibol-diorite-porphyrite.

*Camp LXXIII* was pitched on the left bank of a brook, the largest we had seen ever since *Camp XXVII*. It was covered all over with very strong ice, under which water continued to flow. It came from a transverse valley to the west of the camp and flowed in a big bend, turning across the large valley to the base of the mountains at its eastern side and farther south and S. S. W. Here the height was 4,753 m. or 40 m. above *Loma-yäsung* which indicates the existence of the above-mentioned threshold. Large flocks of sheep and tame yaks were seen lower down the valley, and from some sheepfolds dung could be collected for our fires. Tracks of kyangs were extremely common, — there was scarcely a square foot without them. The animals themselves were seen in several flocks on the slopes of the surrounding mountains. Rabbits' holes were again numerous, though here appearing regionally, some belts being free from them. Pan. 81A and 81B, Tab. 13, serves as an illustration of the general geographic situation around this camp. To the N. 62° E. is the flat threshold separating the river from the basin of the *Loma-yäsung*. To the E. S. E. are the mountains bounding the basin on the south. To the S. S. W. we see the continuation of the valley of *Niring-tsangpo*, though it is somewhat hidden by small hills just south of the camp. From S. 25° W. to S. 88° W. is the comparatively large group of mountains which is situated inside the big bend of the river. Near N. 70° W. is the upper part of the valley of *Niring-tsangpo*. Judging from the size of the river at *Camp LXXIII*, it may come from several days' distance to the west.

On *November 28th*, the distance covered is 10.3 km. to the S. W. and S. S. W. during which the ground sinks 110 m. or to 4,643 m., being a rate of 1:94.

Leaving *Camp LXXIII*, where we had found a *mani-rigmo* on a little hill, we continued along the left bank of the river. Only on its right side, an erosion terrace had been formed, and the river seemed to press along this side. Farther down the running water grows less and less, and finally comes to an end, after which there is only ice in the bed. Ice-sheets were seen also at the foot of the eastern hills in two or three places. The mountains west of the valley are fairly considerable. Where we cross the bed of the river it is already dry, even without ice. At our second crossing the bed sweeps along the base of a dark green schistose rock with a steep fall into the valley. Here from a tributary gorge, an ice-sheet comes out and nearly reaches the principal bed of the valley. The mountains on both sides of the valley are rounded, consisting of detritus, through which here and there living rock makes its appearance. Higher up in a side-valley from the east, large flocks of sheep were grazing, and along the road three Tibetans were dwelling inside the wall of a sheepfold. They told us that four black tents were pitched in the side-valley. The Tibetan nomads are very clever in finding out such places for their camps where the tents are tolerably protected against the eternal, bitterly cold S. W. wind.

The ground of the valley is a little undulating, hard and comfortable, though here and there destroyed by rabbits' holes. The tussock-grass is somewhat higher than before, but more rare than in regions farther north. The mountains to the right side of the valley are pierced by several transverse gorges with screes of gravel at their mouths. Kyangs are very numerous; we had never seen so many animals of this kind gathered on so small an area. At one or two places ice-sheets again appeared in the bed, and finally we passed a very abundant spring forming a regular brook of fine clear fresh water which a little lower down flowed between narrow ice-sheets which by and by grow broader and finally fill the whole bed. Here *Camp LXXII* was pitched. The place, according to the shepherds, was called *Bogar-yung*; the name *Niring-tsangpo*, they had never heard; therefore it is not put on my map. The flocks of sheep and yaks they were watching belonged to a well-to-do nomad farther south, whose tents were situated on our road. Pan. 82A and 82B, Tab. 13, gives an idea of the surrounding mountains. To the N. E. is the valley by which we had come down, to the east and S. E. the mountains at the left side of the valley, to the south the continuation of the latter, and to the S. W., west, N. W. and north the mountains at the right side of the valley. To the south the country seems to be low and open, though bounded far away by low ridges and ranges chiefly running east and west.

The next day's march, on *November 29th*, takes us 12.5 km. south and from 4,643 to 4,503 m. or a fall of 140 m., which gives the relation of 1:89. This is interesting in so far that *Camp LXXV* with its height of 4,503 m. is the lowest camp on the whole crossing through the great Tibetan plateau-land. We had not been so low as here ever since a point a little above *Pobrang*, and even in the deep-cut valley of the *Chang-chenmo* we had been at a somewhat higher altitude than at *Camp LXXV*. South of *Camp LXXV* we again began to rise gradually, and we had to proceed the whole way to the central parts of *Transhimalaya*, at *Bup-chu*, between *Chesang-la* and *Dangbo-la*, and between *Camps CXX* and *CXXI*, before we again descended to such a low level. Even the valley of *Bogtsang-tsangpo* is no exception to this rule, for the lake *Dagtse-tso* into which this river flows, has a height of 4,544 m. During my earlier journeys on the plateau-land of *Chang-tang* proper I had never found any point at such a low altitude as 4,503 m. Therefore, the region around *Camp LXXV* must be regarded as a quite exceptionally low depression. On the other hand, it must be remembered that 4,503 m. is always a rather considerable height in itself, and that a difference of 200 or 300 m. more or less is not very much. From *Camps LXXIII* and *LXXIV*, one sees and feels, of course, that the country is falling in the direction of the road. Otherwise, the features of the landscape are about the same as elsewhere. One difference is, it is true, that here a regular river with well-eroded terraces is directed to the depression.

During the whole night, a strong wind had been blowing and the minimum temperature was only  $-23.9^{\circ}$ . But from 10 o'clock a. m. the atmosphere was in an equilibrium that is very rare on the *Chang-tang*.

From *Camp LXXIV* we go south with the base of the eastern mountains near our left and the chief watercourse of the valley at our right. The mountains are pierced by innumerable gorges and erosion beds directed to the river. As the road follows an old terrace about 20 m. above the river, and as this is also pierced by all the small tributaries, we have to cross them all, which makes this part of the road very tiresome. Several of them have perpendicular sides a few meters high and to avoid them the road goes in a zigzag. Outside the mouths of some bigger gorges and tributary valleys, conical fans have been formed on which the beds of the watercourses have divided themselves in many delta-branches. All the beds are full of gravel. Everything seems to indicate that we have reached a region with more precipitation than those parts of the plateau-land which we have left behind. Probably during the latter half of the summer, the monsoon rains reach these regions. In one of the larger tributary valleys, there is a little brook, from a spring, forming ice-sheets. In the bed of the main brook itself the ice-sheets are very extensive and there are several small islands in the ice. Here the right terrace of the principal brook is well-marked and about 10 m. high, somewhat rounded and pierced by innumerable gorges of the same kind as on the left side. At the latter, the terraces grow lower and finally disappear. To the right or western side of the valley the mountains retreat gradually, are more interrupted, and different groups of them are, here and there, separated by small plains.

Finally our valley opens out into a large plain or arena-shaped steppe with hard comfortable soil of fine gravel with small sparse plants, which, however, come to an end in the lowest part of the depression, and with rabbits' holes which also become more and more rare. The Tibetan road turns S. E., but we leave it and march southwards in the direction of a few black tents. The plain still falls to the south. It is full of tracks of tame animals and of kyangs. Flocks of sheep are visible among the hills to the west, at a great distance. The bed of *Niring-tsangpo* becomes broader and turns more and more S. E. to the lake bed of the depression. At a point east of the river bed, I observed a height of 4,490 m., which is even lower than the altitude of *Camp LXXIV*, though the latter, 4,503 m., is more reliable. When we crossed the bed it still contained some ice. The lake bed, which was left at some distance to the east, seemed to be dry now and filled with deposits like those of the previous depressions. To the S. S. W. there appeared another greenish white bed, which is the continuation of the dying lake. There, springs came up. The depression is oblong from east to west and may perhaps be regarded as a part of a latitudinal valley. On all sides it is bounded by fairly low mountains of violet,

brown, reddish, pink and yellow colours. To the north the hills are more compact, and even the opening of the valley we came down through can hardly be recognized. To the east the country is fairly open, to the south and west the mountains are more interrupted. It is difficult to make out any prevalent orographical order, though it seems as if the general stretching were from west to east. The grass of the steppe is not very good. At *Camp LXXV* there were fresh springs. Near a black promontory to the S. W. four Tibetan tents were visible and two others to the south. The shepherds we had met above *Bogar-yung* had given us the name of *Dirung-ungota* for the large plain; from the same informants we had obtained the names *Yumrang-lopchangs*, *Mukpo-malung*, *Loma-yäsung* and *Bogar-yung*.

Pan. 83A and 83B, Tab. 13, is taken from *Camp LXXV*. The impression of a plain is given principally by the comparatively great distance to the mountains all around. The latter, therefore, seem somewhat lower than they are in reality. The panorama also shows very clearly that these mountains are distributed into different groups and masses, the plastic forms of which betray a very advanced state of denudation. Both to the east and to the W. S. W. the country is open, and the plain may, therefore, be regarded as a part of a latitudinal valley of no small dimensions. The east-west stretching of the mountain ranges and great latitudinal valleys now begins to be more and more pronounced. For several days' marches the tectonic lines had been running north-south. But in the extensive and broad belt of interior Tibet which is situated north of the great lakes and parallel to *Transhimalaya*, the east-west lines are predominating. This fact is clearly illustrated by the stretching of the valley of the *Bogtsang-tsangpo*. The routes of Nain Sing, Littledale and myself, which we would cross within a few days, also indicate the most comfortable direction of progress in this part of Tibet.

According to the general map in 1:1,000,000, constructed by Colonel H. Byström, my two meridional marches from *Camp LXXIII* to the neighbourhood of *Camp LXXV* coincide with the route of Captain Bower in 1891—1892.

The nomads of the district around *Camp LXXV* were not of the hospitable and friendly disposition as the nomads from *Gertse*. They only sold us some sheep, butter and milk, but would not assist us with yaks nor tell us the names of places around the camp. They only told us we had four days more to *Bogtsang-tsangpo*, and in two days we should meet other nomads. They were subject to *Deva-shung* in *Lhasa*, and would not have any intercourse with a caravan in which there was a European.

A wanderer from *Nakchu* made his appearance at our tents and gave us some interesting information that has to be recorded. He belonged to a company of eight wandering tents from *Nakchu* which had made a pilgrimage to the sacred lake of *Manasarovar* and now were on their way home, camping at about half a day's march from us. They reckoned 35 persons including women and children, and had 600 sheep

and 100 yaks with them, from which they get milk and butter and occasionally flesh. However, they spare their own flocks as much as possible and kill wild yaks, antelopes or even kyangs. Not every year, but certainly once in two years such a caravan of pilgrims starts from *Nakchu*. Different families agree to keep together on the journey, as small companies are more exposed to attacks from robbers and thieves. Some caravans accomplish the journey in one year, others in two. The wandering village of our man even calculated three years for the whole pilgrimage. They used to stay some 20 days at every place where the grass was good, otherwise only 4 or 5 days. For the march alone they had needed two months from *Manasarovar* to our *Camp LXXV*, and had about 90 marches from here to *Nakchu*. At the Sacred Lake they had spent two months, and had wandered only once round the lake which had taken three days. The district around our *Camp LXXV* he called *Mogbo-dimrap*, and the small black mountains south of the camp, *Dirung-lopchang*, reminding one of the *Dirung-ungota* mentioned by the shepherds of *Bogar-yung*. Regarding the stations on the pilgrims' road from *Nakchu* to the Sacred Lake, he obviously did not remember their names. At any rate the names he mentioned did not seem to be reliable. However, from *Mogbo-dimrap* to *Nakchu* he gave the following: *Mogbo-tamchuk*, a name that we had heard before without being able to locate it; *Gern-takar*, a white mountain; *Moga-bende*, *Moga-tasuk*, a mountainous region, *Lingkang-tso*, *Moga-taknak*, *Moga-taksum*, *Kanchung-karlep*, *Shintsuk-naruk*, a large valley, *Kolok-tso*, a large lake, *Nor-gerep*, a lake, where curiously enough the Mongolian word »nor» enters instead of »tso», *Scre-yenkär*, a mountain, *Gar, Bum*, reminding one of the *Bum-tso*, *Andar-tsaka*, a salt lake, *Sensung-tsaka*, a salt lake, *Chorgi-tsaka*, a salt lake, *Tsaki-tsangpo*, a river, *Chepcha*, a region »with mountains of sand», which seems to indicate sand-dunes, though such formations are nearly unknown in the interior of Tibet, *Tso-gar*, and finally, *Nakchu-tsangpo*.

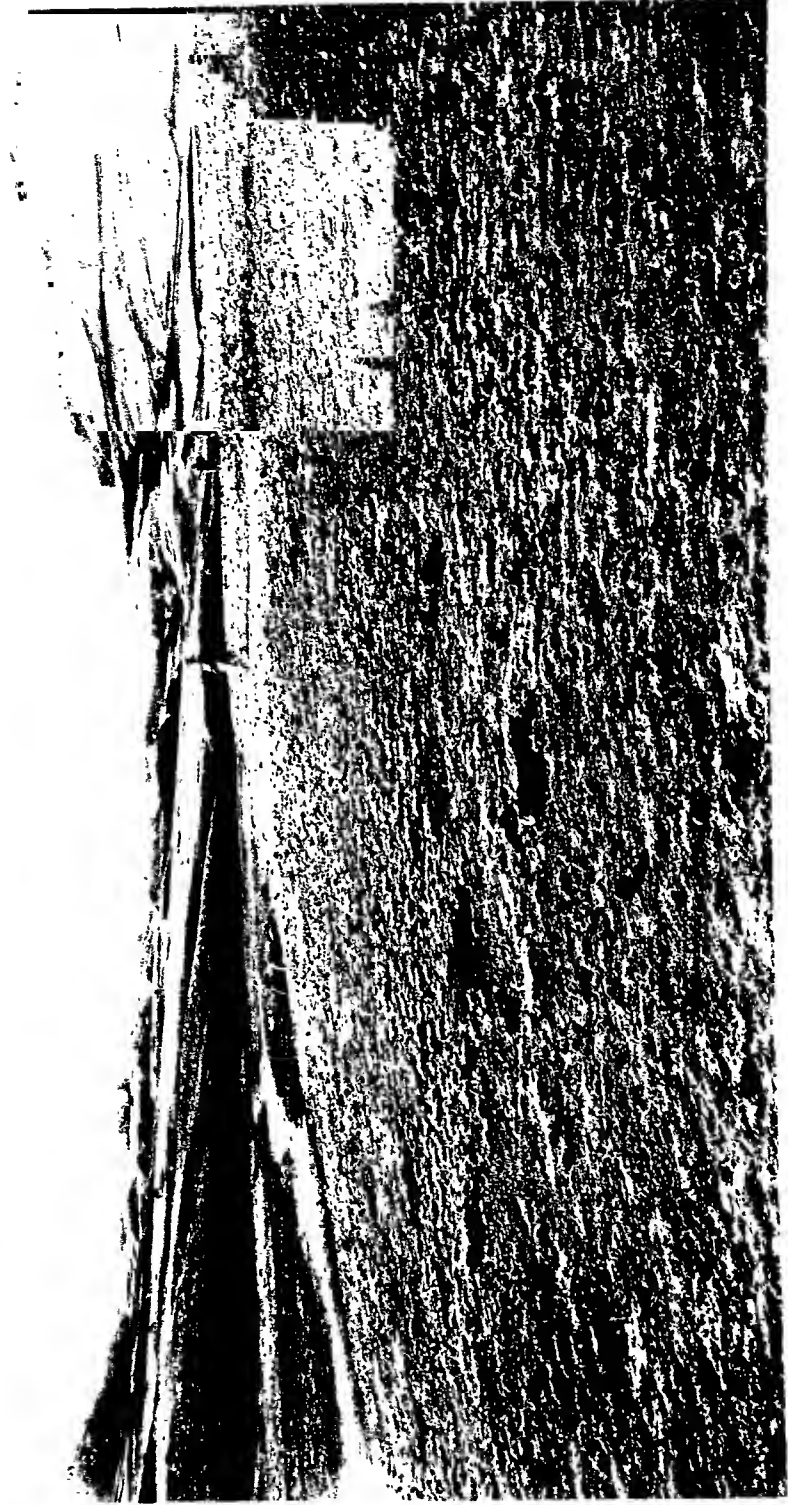
On the road from *Camp LXXV* to the Sacred Lake he remembered the following names of which several are correct and have been mentioned in Vol. II and Vol. III, whereas others cannot be identified: *Argo-chokmar*, *Tagar-dongshö*, *Kartse-martse*, *Kepa-shokta*, a red mountain, *Shakangsham*, a large mountain, *Shara-darlum* with the lake *Shara-yum-tso*, *Sanshen-sanshung*, *Shabuk-nyartse*, a salt lake, *Chimbo-ka-la*, a large ice-mountain, *Gäbjü-sumtang*, a mountain with a plain at its base, *Rakyor-tsaka*, a salt lake, *Penshin-penshung*, a mountain, *Sälung-lopchang*, *Nachebo*, *Maryum-la*, *Tokchen-tokchung*, *Lami-la*, *Gumenang*, *Pilung-lopchang*, and, finally *Hamchu*, a brook near *Tso-movang* or the Sacred Lake. — This latter part of the road is quite clear and marked by such well-known objects as *Shakangsham*, *Ka-la*, *Maryum-la* and *Tokchen*. The first part is more difficult. It seems, however, to be situated north of *Chargut-tso* and *Selling-tso*, two lakes

of the valley of *Camp LXXVI*. *Senjung* was a spring a short distance south of the same camp. *Gelam-lapsang* are the mountains N. E. and east of *Camp LXXVII*, *Uluba* is a mountain N. W. of the same camp, *Chulu-rang* is the valley and spring of *Camp LXXVII*. The pass situated a short distance S. W. of the same camp he called *Kardo-la*, though it was called *Kolok-la* by other informants. *Hoko-la* was a third denomination for it. This apparent confusion no doubt is due to the fact that there are, as we had heard, three different roads across the *Gelam-lapsang* Range, and each of these roads leads to its own pass. *Kolok-la* seems to be the most reliable name for the pass we crossed; the two other passes were said to be situated to the east of it.

Regarding the road in front of us, the Tibetans gave us the following information: *Chupta* was the name of the district where we would have our next camp: south of it we would come across some salt lakes or pools called *Tsering-nakta-tso*, from which we had only one day to *Bogtsang-tsangpo*. *Tagra-ripcha* was said to be the name of a mountain west of *Kolok-la*, and *Pota-lam* a mountain east of the same pass. The latter, however, later on proved to be doubtful, as we found to the north of *Bogtsang-tsangpo* a mount called *Patu-loma*, which indicates a confusion both of names and situation. Our road which was intended to lead us to *Dangra-yum-tso* was said to pass by the following stages, after *Chupta* and *Tsering-nakta-tso*: *Jogdse*, *Daktse*, *Shiseka*, *Chokjung*, *Fontsa*, *Langjung*, *Chama*, *Lamjung* and *Serkung*. I mention these names only for their own sake, for on our road in the direction of *Dangra-yum-tso* we could not identify a single one of them. They may, however, be situated on a quite different road than the one followed by us. Just south of *Kolok-la* a direct road was said to run to *Lhasa* passing by *Dagjung*, *Kabjur*, *Bogtsang-tsangpo*, and *Shagerak*; *Sternгна-gangri* was said to be a snow-covered mountain beside this road.

The day had been cloudy and some snow had fallen on the mountains to the north, one of which was said to be the real *Hoko*. The temperature was a little higher than hitherto or  $-21.6^{\circ}$  on the night of December 2nd and  $-22.6^{\circ}$  the next night. Nor was the wind so hard as before.

The day's march on *December 3rd* was 10.5 km. to the S. S. W., and *Camp LXXVIII* was at 4,784 m. or 107 m. below *Camp LXXVII*. Between the two, we crossed the pass *Kolok-la* at 5,013 m.; being a threshold in the fairly insignificant latitudinal range of *Gelam-lapsang* which thus separates two self-contained basins from one another. Between dark hills a little valley leads up to the pass which is only 22 m. above the camp. On the pass there is a cairn of stones. The living rock here consists of red fine-grained calcareous sandstone. From here there was no other living rock the whole way to *Camp LXXVIII* where light red chalk-limestone cropped out in a little knoll. I hardly had time to draw a half panorama



LOOKING S 80° W. FROM CAMP 79 (COMPARE THE NEXT PHOTOGRAPH).







LOOKING N 80° W FROM CAMP 79.





LOOKING S 50 F FROM CAMP LXXXIX



(Nr. 89, Tab. 15) showing the general appearance of the undulating plateau-land to the north and south before the weather concealed every distant view. Clouds and snow-mist came sweeping from the west and filled the arena-valley to the south of the pass. We had time to discern the ice-sheets of *Chupta* in the south, where we intended to camp. The road to this place crossed a plain or valley between two red ranges or ramifications of no great height. Some kilometers to the south of *Chupta* we had a real gateway between two other red ridges somewhat higher than the first. Beyond this gate, one gets a glimpse of the next arena-valley where the *Tsering-nakta* Lakes were said to be situated. This plain is bounded on the south by a reddish range of moderate height and irregular form beyond which the *Bogtsang-tsangpo* was said to run. Still farther south and beyond the latitudinal valley of the *Bogtsang-tsangpo* a dark-blue range of greater height was rising, having a not very high, but still snow-covered and dominating peak. The view to the south was, therefore, very extensive and we saw our road before us in a straight line for three days' march. But then the snow began to fall, everything, even the nearest hills were hidden and the whole country became white. At the same time the view remained clear to the north, and it snowed only to the N. N. E.

A little valley goes down from the pass, receiving small tributaries from both sides. The descent is short, and soon we reach the quite level plain with some grass and hummocks. After 3.5 km. from the pass we are 192 m. below it, giving a rate of fall as 1:18. Seen from the plain, the *Gelam-lapsang* Mountains give us more the impression of their being a range than from the northern side. To the N. W. the country is quite open; it is a broad valley between small ranges with some rather sharp peaks. The plain falls very slowly to the south and is traversed by four watercourses, all containing ice but no water and probably coming from the western mountains. From the level ground a little knoll of chalk-limestone crops up with partly perpendicular sides and about 20 m. high. At this place which will be very easy to recognise for a future traveller, we had our *Camp LXXVIII* at a height of 4,784 m.

The snow soon disappeared from the ground, but remained on the hills. Hoarfrost covered everything, even the tents, ponies and yaks. In the afternoon it again began to snow, but next morning it had evaporated and only the northern slopes were still white. Here we met three Tibetans on horseback who had visited friends in the north and now were on their way home to their tents a two days' journey to the S. W. They told us that *Tok-daurakpa* was situated a four days' journey to the west. Regarding the ice-filled watercourses we had crossed, they were said to be the upper course of the *Bogtsang-tsangpo*, or at any rate, to belong to the hydrographic system of that river, which very likely was correct.



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From *Camp LXXVIII*, Pan. 85A and 85B, Tab. 14, was sketched. At its beginning to the left, N.  $35^{\circ}$  W., the perpendicular side of the knoll at the camp is visible. Just to the left of N.  $1^{\circ}$  W. is the broad valley mentioned above, and to the right is the saddle with the Pass *Kolok-la*. Then follow the red mountains to the east of our route, and to the S. S. E., the direction of our next day's march.

On *December 4th* we had 14.1 km. to the S. S. W. We rise only 32 m. on this march. *Camp LXXVIII* was at 4,784 m., at the first lake we were at 4,772 m.; then the ground rose to the foot of the mountains with a height of 4,808 m.; a little threshold was 4,854 m. high, and *Camp LXXIX* 4,816 m. After crossing a new, large ice-bed, we ride over hard ground with very poor grass here and there. It is difficult to tell from where these rather large beds come, and it proved impossible to get reliable answers from the Tibetans. It may be that they are branches of one watercourse coming from the latitudinal valley west of *Camp LXXVIII*. The drainage of this valley should, then, be parallel to and fall in the same direction as *Bogtsang-tsangpo*. On his map, Nain Sing has such a river north of *Bogtsang-tsangpo* and called by him, *Chu Zan Sangpo* and in its upper part, *Dongsang Chu* and joining the principal river which he erroneously leads to *Chargut-tso*. Where we crossed the different branches they ran N. E., but, obviously, by and by turn east and S. E.

The country again abounds in game. There were great flocks of kyangs and *Pantholops* antelopes.

We pass the gate-way. Its eastern side consists of a perpendicular rock of chalk-limestone of reddish colour forming a little crest to the east with solid rock in its upper part. The rocks at the western side of the gate have a moderate slope to the north, but are steep to the south, where there are remains of Tibetan camps and sheepfolds. The open space in the gate-way is only about 200 m., and to the eye the ground is perfectly level. South of the gate we soon reach a little depression covered with ice; its bed continues to the west, but is dry here; to the S. E. is a chain of ice-sheets looking like very small lakes. I do not feel quite convinced that we here have anything to do with pools. The location and direction of these ice-sheets seem rather to indicate a bed, through which, after rains, a branch of running water makes its way down to *Bogtsang-tsangpo*.

From the first ice-sheet the ground slowly rises towards the base of the southern mountains. On all sides the plain is surrounded by reddish, irregular mountains with rocky crests, ridges and small peaks, all rising from hills of detritus. The panorama 88A and 88B, Tab. 14, gives an idea of the general relief. From here the road slowly ascends to the little threshold of 4,854 m.; the valley going up, is broad and, to the east, bounded by reddish rugged rocks and hills, and to the west by dark, more rounded and a little higher mountains from which two dry watercourses come down. The

southern one is filled with ice and comes so near the threshold that it seems doubtful whether it flows to the north or the south of it. From the furrows in the ground, it even seems at highwater times to form a bifurcation. *Camp LXXIX* was placed in the very angle between two ice-filled beds, the southern of which also had running water. The joint brook flows to the S.  $50^{\circ}$  E. in a deep-cut valley, and is a left tributary of the *Bogtsang-tsangpo*. In the background to the S.  $66^{\circ}$  E., appeared a snow-covered peak belonging to a comparatively high range or group. To the S. W. and W. S. W. we are aware of a series of small steep peaks, pyramids or pinnacles which rise abruptly from the undulating grass-covered ground of detritus. They are not high, but very steep or perpendicular to the north or N. E. On the accompanying photograph they are clearly visible. This photograph should be compared with the panorama 90A and 90B, Tab. 15, where the same pinnacles are to be found from S.  $52^{\circ}$  W. to S.  $80^{\circ}$  W. They consist of light reddish chalk-limestone. To the N.  $82^{\circ}$  W. we see the comparatively high mount which we left to our right when ascending to the pass. It is visible both on the panorama and on two photographs. The eastern slopes of this mount are furrowed by innumerable dry water-courses. The first-mentioned photograph is an excellent illustration of the general relief worked out by running water and erosion. In the lower part of the principal bed, situated close to *Camp LXXIX*, a part of the ice-sheet is readily visible. One even gets a graphic impression of the hopeless barrenness of the soil, which goes a long way to explain the cause of our heavy losses in caravan animals. Over the hills to the south, the road continues to a pass which we had to cross the next day. No nomads were in sight, the grass extremely poor, and dung very rare.

On *December 5th* our direction is nearly south for 12.2 km. From *Camp LXXIX* we have only to rise 27 m. to a flat threshold, 4,843 m. high, from which the ground slopes down to the bed of the *Bogtsang-tsangpo*, 4,710 m. in height. From the river we again slowly rise to *Camp LXXX* at 4,760 m.

The S. W. wind had been strong again. The temperature was  $-25.4^{\circ}$ .

From the camp we have to cross undulating hills and rather deep-cut water-courses with gravelly beds here and there with small limestone knolls cropping up at the sides, and finally we follow a little watercourse which later on joins the brook at *Camp LXXIX* and originates from the pass. The latter is a flat saddle of quite secondary importance, but is still provided with two cairns and traversed by many paths of tame yaks and sheep. The living rock consists of grey quartz-amphibol-diorite-porphyrity; below the pass the gravel was of dark grey dense aptien-limestone. Pan. 91, Tab. 15, shows the view to the south from this threshold. To the south the valley of *Bogtsang-tsangpo* is bounded by considerable mountains. Down in the valley, the river meanders in several branches all covered with ice. Exactly to the south of the pass the latitudinal valley of the river is very broad and more like a

plain. The fall is so gradual that it would be impossible to tell in which direction the ground slopes. To the west and east the great valley is much narrower and the river here seems to be in one branch. To the S. E. there is a large tributary valley with a ribbon of ice from a spring. In the same direction there is a small snow-peak which we had seen from *Camp LXXIX*. To the S. W. black tents are visible at three different places, and flocks of tame yaks are grazing on the plain. To the west is a pyramidal top with steep sides, dominating the landscape far away to the east and west. From the pass we go down to the plain of this big valley, the ground of which consists of alluvium with some poor grass. Several dry beds were crossed before we reached two ice-covered branches of the river, the latter also containing running water. We camped near the base of the mountains at the right side of the river. The living rock here consisted of brown, weathered limestone.

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LOOKING S 80° W FROM CAMP 80.



## CHAPTER X.

### THE BOGTSANG-TSANGPO.

From *Camp LXXX*, Pan. 93<sup>A</sup> and 93<sup>B</sup>, Tab. 15, is sketched. The first part of it, to the S. 80° W. and west will also be recognized on the accompanying photograph. To the N. 60° W. is a pyramidal peak rising above its surroundings. To the N. W., north and N. E. are the mountains bordering the valley of the *Bogtsang-tsangpo* to the north. It proved to be as difficult as usual to get reliable geographical information and trustworthy geographical names for different places and mountains. Some of the names, however, agreed with those given by Nain Sing, but not with the few names I heard on my journey in 1901 along the *Bogtsang-tsangpo*. In some cases, of course, one mountain may have two or more different appellations. Speaking of a mountain group, different parts or peaks of it may have their own names, and misunderstandings may arise. Along such an important river as the *Bogtsang-tsangpo*, there may be a great number of names. The same will be the case with the tributary valleys north and south of it. Some nomads may be accustomed to camp every year at certain grazing grounds for which they have special names, and other nomads may camp at other places. The former, when asked, will only give their usual names, the latter only the names of their own grazing-grounds. The result may be that the visitor gets the impression that one or both tell lies, though this is not necessarily the case. The Tibetans are too simple-minded and realistic to be able to invent false names. But on the other hand they may make mistakes, and wrong names may, therefore, be entered on the map. These will have to be checked, controlled and improved in the future. Everything cannot be obtained at once; one has to proceed with patience and satisfy oneself for the time being with the information given.

However, I cannot simply dismiss the information given by the Tibetan chief from the neighbourhood of *Camp LXXX*, and enter it here under reservations. The black pyramidal or tetrahedral mount at the northern side of the latitudinal valley and to the N. 60° W. from *Camp LXXX* (*cp.* Pan. 93<sup>A</sup>) he called *Tugu-lamo*<sup>1</sup> as

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<sup>1</sup> Obviously the same as Nain Sing's *Dábú Lhámo Pk.*

spirits were said to dwell on it; common people used to call it *Rinak-lamo*. *Gobrang*<sup>1</sup> signified the range or group of mountains east and N. E. of *Rinak-lamo*. *Ragok*<sup>2</sup> is the principal valley from *Gobrang*. The name *Lungnak* used by Nain Sing was seldom heard. Our informant at *Camp LXXVIII* had never heard the name *Chupta*, he called that place *Mukbo-dabrak-yung*. The ice-beds we had seen at *Camp LXXVIII* joined in a watercourse which he called *Dongsang-chu*. *Naling-shung-chu*<sup>3</sup> was another watercourse in this region. Some days' journey to the south, he knew of a large lake called *Teri-tso* which, of course, is the same as *Teri-nam-tso*.

From *Camp LXXX*, which he called *Shurang*, he reckoned 9 days on horseback to *Dagtse-tso*, which was the same name I had obtained in 1901. The shortest road to this lake does not follow the river the whole way; its principal stages were: *Teshen-rapka*, *Kamrek-la*, *Bolo-kakar*, *Hamo-tsang*, *Nya-naglong* and the lake. A road along the river passes by *Teshen-rapka*, *Shüteri*, *Tsarap*, *Kevarung* and a nameless place, to the lake. In both cases it would, therefore, be 6 and not 9 days, the latter probably being our slow speed of travelling. From *Camp LXXX* he knew three different roads to *Dangra-yum-tso*. The western-most one enters the meridional valley that opens out just west of *Camp LXXX* and seems to run south of Nain Sing's road. It is 8 marching days long, and passes over difficult and accentuated ground with bad grazing, though nomads are to be found at most places. Its stages are: *Loma-nyedo*, *Amla*, a little pass, *Chagar-dotsar*, *Chemo*, a valley, *Chokchu*, a valley, *Shalung*, a valley, *Ngamngur*, a little lake, and finally, *Dangra-yum-tso*. This road seems to reach the great lake at about the middle of its western shore, or perhaps even somewhat farther south. The names given here are reliable. *Ngamngur* is probably Nain Sing's *Ngangon Cho*. Of *Chokchu* I heard later on at *Selipuk*, where I met a chief and a large caravan of pilgrims from the district of *Chokchu*, which was said to be situated just west of the central part of *Dangra-yum-tso*.

The second road to *Dangra-yum-tso* is obviously the same one as the one taken by Nain Sing. It begins, as the first one, by the valley just west of our camp, and then passes by *Kabu-kare* which is identical with the Pundit's *Gipu-khárá*, *Kyang-tsauk*, *Kiro*, *Kilung-po*, identical with the Pundit's *Kilong Pass*, and finally *Ombo* on the shore of *Dangra-yum-tso*, and obviously at the very N. W. corner of the lake. Nain Sing's *Gara-Dong-kung* and *Thok Chigimila* were said to be situated at a short distance N. E. of the road. Nain Sing's *Taksa Domsa* was also quite correct and pronounced in the same way; it is the culminating snow-peak of the mountain group which is partly visible on my panorama 90B, Tab. 15, to

<sup>1</sup> *Gobráng* on Nain Sing's map.

<sup>2</sup> Probably the same as Nain Sing's *Ragú*.

<sup>3</sup> Nain Sing has a *Nale Lhángo*.

the S.  $50^{\circ}$  E. and S.  $66^{\circ}$  E. from *Camp LXXIX*. The name *Pota-lam* which we had heard before was said to appertain to a peak in the same district, though not visible from our route.

The third road to *Dangra-yum-tso*, the eastern-most of the three, goes eastwards to *Patibo* on the *Bogtsang-tsangpo*, thence to *Seri-peri*, a valley and mountain just south of my *Camp LXXXIII*, where it turns to the S. E. and crosses a pass of moderate height called *Pola-la*, thence to *Tang-yung-tsagla* and the little salt lake *Tang-yung-shagga*, thence to the hot spring *Marpo-chutsan* and finally to *Ombo*, a place on the northern shore of *Dangra-yum-tso* where barley is grown. The salt lake *Tang-yung-tsaka*, called *Dang-yung-shagga* by our informant, is Nain Sing's *Tang Jung Cho*. All three roads were said to be poor in grazing-grounds.

Another informant whose communications could not be checked, asserted that the region around our *Camp LXXX* was called *Shub-she*, and that 13 black tents were pitched in our vicinity. He also said there was a fourth road to *Dangra-yum-tso* which of course may easily be true; it was said to go one day eastwards to *Longmu-tarok* and thence to *Gara-takung*, *Shkelung-la*, *Panpo-gompa*, *Chuptso-gompa* and thence two days to *Dangra-yum-tso-gompa*, where 30 lamas were living. This itinerary is curious in so far as it mentions three monasteries of which no European has ever heard. Of *Särshik-gompa* at the southern shore of the lake I later on got reliable information, and I had already been told that four monasteries are supposed to be situated at the shores of the lake. But no details have reached European ears. It is, however, not unlikely that gompas are built around this lake, which is regarded as sacred and visited by pilgrims. This also is the case with *Tso-rinpoche* or *Manasarovar* as we know. This second informant also said that the region between our route and *Dangra-yum-tso* was full of mountains, uncomfortable for travelling, and poor in grazing. Everything I heard corroborated the report of Nain Sing, and I had a new opportunity to admire the conscientiousness of this famous Pundit. Only, regarding the general course of *Bogtsang-tsangpo*, he was mistaken in directing it to the N.  $60^{\circ}$  E. instead of east and to make it an affluent of *Chargut-tso* instead of *Dagtse-tso*.

On *December 7th* we made 12.5 km. to the N. E., experiencing no changes of altitude worth mentioning. *Camp LXXX* was at 4,760 m., halfway between, we had 4,733 m., and at *Camp LXXXI* 4,788 m.

The weather had been windy the last few days. The night temperature sank to  $-27.5$ ; the morning was clear, but in the afternoon the whole sky became covered with thick clouds.

We followed along the base of the mountains at the southern side of the valley; they are reddish brown, rounded hills, and only here and there living rock is cropping out. From a transverse valley an ice-ribbon goes out on the plain



where it soon comes to an end; it is fed by a spring. In the same valley and protected against the ordinary wind by a projecting mountain, two tents were pitched and flocks of sheep were grazing. The ground is very level and comfortable and consists of fine gravel with some grass and tussocks; later on there is no gravel but alluvial clay, now hard as stone but soft during the summer, as could be seen from the numerous tracks of ponies, kyangs and yaks. They were sunk deeply into the ground which, during the rainy season, must be rather treacherous.

We approach the opening of a large valley from the S.E. Outside its mouth we cross several erosion furrows coming from the mountainous regions to the N.E. of Nain Sing's route. This great valley is to be found on Pan. 95A, Tab. 16, which also shows the mountains all around the horizon, among them several considerable peaks of pyramidal or conical form. The region was rich in kyangs grazing in great herds. *Camp LXXXI* was pitched not far from an isolated mountain group to the north of which the *Bogtsang-tsangpo* flowed in an apparently narrow valley.

The march of *December 8th* is only 8.1 km. *Camp LXXXI* is situated on a flat threshold, 4,788 m. high, whilst *Camp LXXXII* on the river has only 4,707 m.; the fall is as 1:100. The temperature of the night was  $-26.4^{\circ}$ ; in the morning there was a W. S. W. storm, the whole sky was covered with dark clouds. The soil of sand and gravel is hard and comfortable, with some poor grass. The mountain group to our left consists of greyish red dense albién-limestone, and forms very steep promontories and shoulders with narrow and steep gorges between. The height of this isolated group is only about 150 m. The breadth of the valley may be some two miles. From the camp we rise to a water-parting, so flat that it cannot be noticed; on its eastern side, however, one feels that the ground slowly falls. There are no erosion beds. The mountains at the southern side of the valley are somewhat higher than on the northern; and several transverse valleys and gorges open among them. One of them has a spring and is called *Teshung*. *Pati-bo* is the name of the promontory of the northern group at the very base of which the *Bogtsang-tsangpo* comes out from a narrow valley piercing the mountains. The river is streaming in capricious beds and has a right terrace, well-marked and 4 or 5 m. high. There are many fireplaces here and several tents are said to pass the summer at *Pati-bo*. With the terrace to our right, we follow the bank of the river which, as a rule, was frozen over, but open at a few places. At *Camp LXXXII* the ground is alluvial clay; the grass was tolerable and dung was to be had.

In this region some tents from *Ombo* on the *Dangra-yum-tso* are passing the winter, as the grazing near the lake is miserable. The Tibetans from *Ombo* told us that the lake is salt and that no road runs all around the lake on account of the steep mountains at several places. Pilgrims who wander around the lake



LOOKING S 60° E FROM CAMP 83.





LOOKING S. S. E. FROM CAMP 83.



have, therefore, to cross some steep passes. In the valleys here and there nomads are living, and there are a few monasteries, the lamas of which get their food gratuitously from the nomads. At *Ombo* there is only one house with 30 or 40 inhabitants. They are very poor, and their sheep and yaks are brought to *Bogtsang-tsangpo* for the winter. From the lake there is no direct road to *Shigatse*, only a roundabout way 30 days with yaks, 15 with ponies. The surroundings of *Dangrayum-tso* were usually described as very poor and inhospitable, though the unfavourable descriptions may have been given to discourage us from visiting the sacred lake.

At *Camp LXXXII* Pan. 94<sup>A</sup> and 94<sup>B</sup>, Tab. 15, was sketched. The valley of the *Bogtsang-tsangpo* is the most bewildering and inextricable part of Tibet I have visited. It is not simply *one* great regular latitudinal valley with mountains to the north and to the south and the meandering river between them, which would be very simple and easy to recognize. It is a system of small parallel mountain ridges and ranges principally running east and west. Very often, especially in the region between *Camps LXXXII* and *LXXXV*, they have no visible connection with one another. In other cases they are pierced by the river in narrow gorges. In still other cases the river seems to flow in a semi-circle around one such little mountain group. Such instances are to be found on my Pl. 67 in Vol. II of the Atlas of my *Scientific Results of a Journey in Central Asia*. Now, when returning to the *Bogtsang-tsangpo* a second time, several discrepancies were found between the two maps. A comparison between the two routes shows that I have not followed exactly the same way in both cases. Therefore the two maps do not agree, and the differences between them are in some cases rather great. In 1901 I also travelled partly north of the river and, on its southern side, to the south of small mountain-groups and hills, which I, in 1906, left to the south and saw from their other side. This fact changes the landscape and perspective completely. At two or three points where I have camped both times on the southern bank of the river, Colonel Byström, by constructing the general map in 1:1 000 000 has been able to check the coincidence of the two routes. Between my *Camps LXXXII* and *LXXXV* of 1906, is a distance of 26.5 km. Between my *Camps XCIII* and *XCIV* of 1901 the distance is 30.0 km. Now these camps cannot, of course, be at the very same places, but approximately they are so. In both cases the river makes a large bend to the north and disappears from sight. It is not easy either to see *where* the river turns to the north and *where* it comes back to my route. Mistakes can easily be made. There are frozen branches of the river which during the winter have been cut off, and at other places the principal branch of the river may be hidden by its own fluvial terraces. The river is thus meandering in a most irregular way between this labyrinth of isolated rocks and hills. Thus the great northern bend spoken of before goes around several groups of hills. As my route of 1901 goes farther south,

I saw other hills there than in 1906 when the route sticks to the level ground of the valley. The *Karlung-tso*, near the shore of which *Camp LXXXIV* is situated, was only visible at a distance in 1901. To the north of *Camp LXXXI*, the topography and hydrography are uncertain. Just above this camp, to the north or N. E. we observed a channel of the river 6 m. broad, and half a meter deep with a strong current. This branch is probably one of those we crossed between *Camps LXXIX* and *LXXX* and probably this branch pierces and cuts in two parts the little mountain group of *Pati-bo* in the same way as between *Camp XCIV* and *Camp XCV* of Pl. 67 of my former journey. *Camp XCV* of 1901 must be situated at some 6 or 7 km to the W. N. W. of *Camp LXXXI* of 1906. On Pl. 18, Vol. IV, p. 124 of *Scientific Results*, the lower photograph is obviously identical with the *Rinak-lamo* visible on Pan. 93A, Pl. 15, to the N. 60° W. The compass direction perfectly agrees in both cases, as well as the form of the pyramidal mountain and its surroundings. The region of *Camp XCV*, 1901, was then called *Rinak-sumda*. As I have said before, *Camp LXXXII* of 1906, coincides approximately with *Camp XCIV* of 1901. This may be shown also by comparing Pan. 94A, Pl. 15, where the mountain north of the river, from N. 5° E. to N. 42° E. is the same as the one on the photograph of Pl. 17, Vol. IV of *Scientific Results*, p. 121. There is only a little difference of perspective proving that the panorama is sketched some distance farther west than the place from which the photograph was taken, or in other words, that *Camp LXXXII* of 1906 was some 2 or 3 km. west of *Camp XCIV* of 1901. Finally it should be noticed that there is a difference of about 7' 50" of longitude between my maps of 1901 and 1906 so far as the valley of the *Bogtsang-tsangpo* is concerned. A day will come when the valley of the *Bogtsang-tsangpo* as well as other parts of the unknown or little known Tibet will have to surrender its secrets to human enterprise and thirst for knowledge. Only then the topographical problems which have seemed intricate to me will be cleared up. To us the difficulties regarding agreement between my two maps increased in no small degree due to the fact that I, in 1901, travelled from east to west, and in 1906 from west to east. Such an irregular landscape as this, consisting of a labyrinth of small, more or less detached, mountain groups has quite a different appearance when seen from opposite sides. Only a detailed topographical mapping is independent of the changing perspective.

On *December 9th* we marched for 7.5 km. along the southern or right bank of the river. *Camp LXXXII* has a height of 4,707 m. *Camp XCIV* of 1901, which we found a little to the east of the last-mentioned place, was at 4,718 m. which also speaks for the identity of the two places. *Camp LXXXIII* was at 4,652 m. or a fall of 55 m., being at the rate of 1:136. This is no steep fall. Now of course we have to remember that observations made only twice at a place,

with a boiling point thermometer and three aneroids, can never be sufficient to give a correct absolute height. The atmospheric pressure changes constantly, and the difference may be great from one day to another. The heights obtained are, therefore, only approximate, which, to a great extent, explains the discrepancies between the altitudes given by different travellers for the same place. But as long as we do not possess absolutely reliable means of determining the heights, we must be satisfied with approximate values. When travelling along a river we have a means of checking the altitudes given by the barometric instruments. Going down the river every camp must be lower than the previous one. Therefore either the 4,652 m. of *Camp LXXXVIII* are too low, or the 4,664 m. of *Camp LXXXV* too high. But *Camp XCIII* of 1901 which we found to coincide approximately with *LXXXV* of 1906, was only 4,644 m., which certainly comes nearer the truth than the 4,664 m. of 1906. As to the fall of the river, it can only be fixed by levelling with instruments of precision. The same is, of course, true regarding every undulation of the ground. Like all other rivers, the *Bogtsang-tsangpo* has a very changing current. At some stretches of its course the current is very slow, at others it even forms small rapids. As in all rivers, the velocity of the current and the rate of fall diminishes towards the mouth. The greatest fall is in the upper reaches of the river. Such is also the case with the *Bogtsang-tsangpo*. On the 7.5 km. march between *Camps LXXXII* and *LXXXIII*, the fall was as 1:136. But if we take the whole distance from *Camp LXXXII* (or *XCIV* of 1901) down to *Dagtse-tso* a distance of some 115 km. we get a slope of 1:661, which may indeed be regarded as extremely gradual. This fact is also in accordance with the whole structure of the country. The river is, as it were, searching for its way. The small hills and ridges cropping up in detached and isolated groups, are the highest parts of whole mountain ranges and systems which have in the course of ages been buried to the greater part by the deposits of débris and detritus. On the surface of these beds filling the intermediate spaces, and between the remains of mountains still fighting against destruction, the *Bogtsang-tsangpo* is still, in its old age and with constantly diminishing energy, working its way down to *Dagtse-tso*. At places where it flows over nearly horizontal ground, as just below *Camp LXXXV*, it describes the most fantastic bends and windings. Such is indeed also the case at and just below *Camp LXXXII*, though here the slope is comparatively steep as may be seen by the current; it even appears very distinctly on the photograph on Pl. 17, Vol. IV of *Scientific Results* mentioned above.

On the night of *December 9th*, the temperature fell to  $-29.0^{\circ}$ . By such cold weather, most of the river was frozen solid. We continue down the valley to the E. N. E. and finally N. E. with partly rocky, desolate and barren mountain ridges of reddish, pink and yellow tints at both sides. To begin with, the ground is



granulated or knotty, overgrown with low grass and perforated by innumerable rabbits' holes. The northern ridge, as may be seen on the panorama from *Camp LXXXII*, is more continuous and has very steep rocky slopes. A little transverse valley pierces them, opening to the N. 7° W. on the last-mentioned panorama. The scree of gravel and débris at the base of the southern mountains reaches the vicinity of the river, and one of them, with hard barren ground of fine gravel, projects farther than the rest and is crossed by our road. The plain part of the valley may be one mile, or a little more, broad. At intervals we touch the south-going bends of the river. The ice-sheet of the river is concave and broken up at the banks, proving that the volume of water decreases gradually during the winter. In 1901 I had found much more water in the *Bogtsang-tsangpo*, but then the season was earlier or in the first days of October. The river is almost entirely fed by springs, which get completely frozen as soon as the severe cold sets in. It is the rains of late summer that again brings life into the springs, and they are very numerous in the valley of this river. The *Bogtsang-tsangpo* may be regarded as a recipient of the water of innumerable springs. After rains it receives direct affluents. Some springs do not freeze even during the coldest part of the winter and if they are not too far from the river, their water reaches its bed. Probably some water keeps running during the whole winter under the ice-sheet. Now the volume was only about 1 cub. m. a second at *Camp LXXXII*, but increases slowly down the course on account of new tributaries. East of this camp we passed a spring the brook of which did not freeze until some 50 m. below its beginning. It formed a pool covered with ice, but from there continued to the river. The right erosion terrace is always clearly visible, though sometimes rather low; at *Camp LXXXII*, for instance, only 2 m. Farther on, at a new bend of the river, a little partly open brook goes out to the river which here is open for about 100 m. along the right bank, though only to a breadth of 1 m.

Then we cross the plain at some distance from the river which disappears from sight. But sometimes we ride over old abandoned beds, some of them dry, others containing ice-sheets, but no water. On account of the levelness of the ground, the river seems from time to time to change its bed. The river sticks to the northern side of the valley which is due chiefly to the screes from the southern mountains. Between their base and the base of the northern mountains the profile of the valley here forms a straight horizontal line. In this plain part of the valley the ground consists of clay and alluvium without a single stone.

*Camp LXXXIII* was pitched at a branch of the *Bogtsang-tsangpo* which seemed to be cut off from the main river with the running water. The latter probably turns to the N. E. just at the eastern base of the *Patu-loma* mountain group. The panorama, 99A and 99B, Tab. 17, was sketched from *Camp LXXXIII*. To the

N. 29° E. we have a fairly broad opening between the mountains; to the N. E. is a narrower valley by which the river was said to flow. Here the region was called *Rinek-türgüt*. To the N. 70° E. is a more considerable mount called *Karlung* or *Karvung*, and in the same direction, though much nearer is a blood-red mount called *Lamar*. Directly east and near our camp is an apparently conical mount, which later on proves to be a ridge stretching W.-E. The region to the S. E. was called *Seri-peri*, and the plain, *Seri-peri-yung*. The mountains to the N. 55° W. were called *Tage-ring-po*. The section of this panorama that falls between the east and S. 9° W. may be checked by comparing it with the two accompanying photographs, of which the second is in direct connection with the first. At the right margin of the second one, a cut-off branch of the river is visible, covered with ice and with a well-developed, though low erosion terrace. Large flocks of sheep were grazing on the plain, and four black tents were in sight. The sky was clear, but a strong S. W. wind was blowing.

On *December 10th* we made 9 km. to the east. The ground ascended only 44 m. from 4,652 (*Camp LXXXIII*) to 4,696 m. (*Camp LXXXIV*), or at a rate of 1:205. We proceed towards the mount to the east, visible on the panorama and photograph taken from *Camp LXXXIII*. At the base of the mountain there are several springs, forming a brook which soon freezes into large ice-sheets. To the left we leave the bed of the river and its ice-filled branches on the level ground which by a little terrace is bordering upon the edge of the very flat scree from the isolated mountain. The river soon disappears and we slowly rise. To our left, there are several ice-sheets which may be small lakes or pools, but more probably are patches of flat land which is inundated at the highwater season. We follow a latitudinal valley with slowly rising ground. To the north, between and along the bases of the small detached mountains, we see winding ice-sheets, but it is very difficult to determine the real course of the river, as it is impossible to distinguish between the river bed and the inundations. So much seems certain: that the *Bogtsang-tsangpo* winds its course north of the isolated *Lamar* Group. The soil is hard gravel and sand, nearly barren; at such places there are no rabbits. The mountains on both sides of the latitudinal valley are interrupted, irregular and capricious, resembling crenelated walls, with naked rock along the crests and more or less steep screes along the base. They form several parallel ridges and small ranges stretching east and west, as can be seen through the openings of the transverse valleys. In several of these valleys and on the slopes of their tributaries, which also stretch east and west, ice ribbons are visible, showing the existence of springs. In the middle of a large transverse valley, which comes from the *Seri-peri* region, there is a continuous ice bed reaching down to our road. The ground becomes more even and finally falls slowly towards the *Karlung-tso*.

On its N. E. side the peak, *Karvung*, raises its rocky, dominating height above the surrounding country. At the foot of the *Lamar* and *Karvung* Mountains, a little lake extends its compact ice-sheet, hardly a mile wide. Its water is perfectly fresh. At its southern shore many springs come up, forming very irregular ice-sheets between the little cones of tussock-grass. To the south at least three parallel ranges are visible, the southern-most of which, called *Shirilok*, has some snow on its crest. To the east, the latitudinal valley continues so far as the eye can see. Far to the east its bottom forms a horizontal line above which a few peaks show their heads.

At *Camp LXXXIV* there were no nomads. The Tibetan chief who accompanied us, gave some scanty information about the climate. He said that the strong S. W. wind would blow six months longer, or until about the season when the new grass begins to come up, which would be the middle of June. During the summer there are no prevailing winds; it blows from all directions. Rain falls in the summer months but very irregularly; some years very abundantly, other years very little. The nomads long for rain, which makes the grass richer and the flocks fatter. At barren places the ground becomes very soft and the animals sink deeply into it like in a quagmire.

Our informant had been in *Lhasa* and *Shigatse* and had taken the way which lies to the west of *Dangra-yum-tso*, crossing five passes of which one was high and difficult. By following this road, on which he had not met nomads every day, he had reached the large valley of the *Tsangpo* at *Ye*, as we did. He had not passed any lakes except *Dangra-yum-tso*. He had followed a *ser lam* or gold road, *i. e.* a track generally used by gold-diggers. From *Dangra-yum-tso* there was a road, passing *Shansa-dsong* on the *Kyaring-tso*, to *Lhasa* and *Shigatse*. But on the track which we intended to follow to *Dangra-yum-tso*, we would be far from all beaten paths and rarely approach regions visited by wanderers. The lake itself was at a very out-of-the-way place, visited only occasionally by pilgrims. It is like a cavity surrounded on all sides by high mountains.

On *December 11th* we marched 10 km. to the E. S. E. and east, descending 32 m., or at the rate of 1:313, as *Camp LXXXI* had an altitude of 4,664 m. The marches were very short, for the yaks, when loaded, are not accustomed to long marches and have to be spared. The road is good and comfortable as everything is frozen solid. Here and there the soil contains salt and must be marshy in summer. From the southern mountains, erosion furrows come down, some of them containing ice. To begin with, they are directed to the little lake, but farther east they turn to the river. A very flat threshold, not discernible with the naked eye, separates the basin of the lake from the area of the river. Living rock was passed at a little knoll consisting of greyish red dense albien-limestone, which predominates in the whole region along the river. In their state of weathering and denudation, they

appear in very rugged, rocky and irregular forms. The little limestone ridge continues eastwards until it is suddenly interrupted by a large meridional valley from the south, which opens up a distant view in this direction and shows, in the background, a dark range higher than the rest and of a rounded outline, indicating that it consists of another kind of rock. From this valley several gravelly beds come down, directed to the narrow gate to the north, from which the *Bogtsang-tsangpo* again comes out.

A little west of this valley, Pan. 98, Tab. 17, was taken. This sketch gives a much better idea of the general appearance of the country and its relief than any descriptions in words. To the N.  $75^{\circ}$  W. it shows Mount *Lamar*, and to the N.  $53^{\circ}$  W., Mount *Karcung*, and the southeastern ramifications and ridges of this group. To the N.  $17^{\circ}$  E. is the narrow transverse valley where the *Bogtsang-tsangpo* pierces the mountains and again returns to the latitudinal valley we had followed hitherto. Just at the place where the river flows out of its rocky gate, *Camp XCIII* of 1901 was situated, about 3 km. N. W. of *Camp LXXV* of 1906. The photos taken on the first occasion and published in Vol. IV of *Scientific Results*, should be compared with this panorama. To the N. E. and E. N. E., we see the mountain ranges bounding the large valley of the river. The view to the north is brilliant. In the gate between the mountains, the river winds with its ribbon of blue ice and its yellow banks. In meanders, sometimes forming three quarters of a circle, the river seeks its way along the base of the northern mountains, proving that the ground of the latitudinal valley slowly falls to the north, as can also be seen on all the dry watercourses from the transverse valleys in the southern mountains. The northern mountains are wild and rugged with rocky shoulders and steep slopes; their screes and fans are steep and rounded and pierced by all the small tributary valleys and their erosion beds. The base of these screes and fans, is cut and eroded by the river. It seems curious that the stream, instead of sticking to the flat and open latitudinal valley where no obstacles rise in its course, accomplishes these extraordinary roundabout ways between the mountain groups north of this valley, sometimes piercing ranges of hard rock which ought to have been insurmountable obstacles in its way. This seemingly surprising arrangement can only be explained by a thorough geological survey of the whole region and a deep understanding of the history of the river. The river is old, it is almost dying. An insignificant secular upheaval of the ground in the midst of its course would cut it into two parts, the eastern of which would belong to the *Dagtse-tso*, the western forming a new self-contained basin. It is also surprising that the river has not had force enough to cut out a deep and well-defined bed, but is flowing in a very superficial way on the top of recent deposits in the valleys. Though it is diminishing by the general desiccation of the whole country, which also forces the lakes to dwindle, it is still

one of the largest rivers of the extensive interior parts of the Tibetan plateau-land which has no outlet to the sea.

*Camp LXXXV* was situated at the southern bank of a cut-off branch of the river, which here makes the most extraordinary windings in all directions. The branch was very broad and was more like a pool, with water under the ice. Sometimes the formation of ice causes inundations which conceal the real hydrographical features. Here the river itself was frozen everywhere.

Panorama 97A and 97B, Tab. 16, is taken from *Camp LXXXI*. It shows the open passage of the western continuation of the latitudinal valley. Between N. 64° W. and N. 50° W., is the comparatively narrow gate by which the river comes out, as shown on the last panorama. To the N. W., is a mountain ridge called *Tsaksing*, or, by another pronounciation, *Yaksing*. At a greater distance to the N. N. W., there is a ridge called *Tingu*, and to the north, at some kilometers distance from the river, the range and peak of *Amkak*. To the N. E., there is an interruption between the hills: a kind of smaller latitudinal valley. To the N. 57° E., is a ridge called *Ambum-karpo*. The latitudinal valley continues to the east, though a distant view in that direction is hindered by the slope of a scree from the south. To the S. 59° E., is the peak *Tak-surmo*. To the S. W. the hills of *Shirilok* are still visible. Six tents were said to be pitched in our surroundings, and at several places we could see flocks of sheep and yaks. There is no lack of water, for white ice-sheets are to be seen in nearly every tributary valley. In the valleys to the north of the *Bogtsang-tsangpo*, the tents were said to be more numerous, as the winter grazing is better there than along the river. In the late autumn not very much of the summer grass is said to be left along the river, and, therefore, most of the nomads go north for the winter. During the last few days, the night temperature had been at -27.2°, -26.2° and, on the night of the 12th of December, -31.5°. In the afternoon of the 11th, the temperature rose for a while, even to a little above zero, which had not been the case for a long time. Still the S. W. wind was strong as usual.

On *December 12th*, our march was 10.5 km to the S. E., rising to 4,770 (*Camp LXXXVI*) or 106 m., a rate of 1:99. From the camp we again go up on the top of the erosion terrace and have the winding river to our left and the little peak of *Tak-surmo* to our right. The left terrace of the *Bogtsang-tsangpo* is farther away from the river and higher and more energetically developed, as the erosion presses upon the base of the northern scree. The *Tak-surmo* continues eastwards or E. S. E. as a series of irregular peaks and rock pyramids. From a transverse valley to the south, a mighty ice-filled bed comes down and reaches the river, though it does not seem to have any running water now. In the summer the valley must have a brook, the largest tributary we had crossed. Finally we turn S. E. and nearly south, up



LOOKING S 62° E TO S 5° E FROM CAMP LXXXVI, NAVA





THE BOGTSANG-TSANGPO. LOOKING W. N. W. FROM A POINT  
HALFWAY BETWEEN CAMP 85 AND CAMP 86.





into a valley where the rise is noticeable and the ground, which hitherto has been hard gravel, is more uneven, covered with moss in small patches, and again pierced by rabbits' holes. In the middle of the valley is a bed continuing down to the river. On its other side, there were seven tents. Higher up the ground is very uncomfortable as it is crossed by innumerable small beds and furrows from the wild rocky hills to the west. They are also seen on the eastern slopes, coming from higher pink-coloured mountains. The rock is the same kind of limestone as before. We reach a little threshold which probably is secondary, and only separates two tributaries of the *Bogtsang-tsangpo* from each other. The threshold is also composed of limestone. A little east of it was a lonely tent. On the southern side, a spring comes up and freezes almost immediately. We camped in the *Nasa* valley, which was directed to the east and then to the N. E. To the S.  $36^{\circ}$  E., we could see the pass in the southern principal range forming a regular saddle, with the ice of a spring on its upper part. Near our camp a spring comes up, and its ice ribbon is seen winding down the valley. In the summer there is a little brook, the bed of which cuts through the mountains to the N. E.

A new itinerary to *Dangra-yum-tso* was given us here, though only with two names and very unreliable. If going straight south, we should, on the first day, camp at a place with three tents from the district of *Tang-yung*; the second day in a valley with five or six tents where barley is cultivated; the third day at the monastery of *Pembo-gompa*; the fourth day in a region with nomads' camps, and the fifth day on the shore of *Dangra-yum-tso*. It is surprising to hear from different informants that other monasteries than *Särshik-gompa* exist at or near the *Dangra-yum-tso*, though they have remained perfectly unknown to Europe.

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## CHAPTER XI.

### TO DUMBOK-TSO.

On *December 13th* our journey proceeds to the S. E. and S. S. E. From *Nasa* we have 4.2 km. to the pass *Gyanyak-la* or *La-gyanyak*, as it is also called, the altitude of which is 5,161 m., meaning a rise of 391 m., or at the unusually steep rate of 1:10.7. On the southern side of the pass we have 2.8 km. to *Camp LXXXVII*, where the height is 4,875 m., or a descent of 276 m., being a fall of 1:10.1. The profile of the latitudinal range in which the pass is situated is, therefore, comparatively accentuated.

At about 9 o'clock p. m. a regular S. W. storm set in and continued the whole night and the next day. The minimum temperature was only  $-10.3^{\circ}$ , or  $21.2^{\circ}$  warmer than the previous night. Such enormous variations are indeed curious. The sky was covered by heavy clouds, hindering the usual strong radiation. All loose material was swept away by the wind. The corrosion of the ground is, to a large extent, stopped by two factors. In the summer the loose material, dust and sand, is bound by moisture and rain and cannot then be moved even by the strongest winds. In winter the same material is frozen, by which the force of the wind is diminished. But at seasons when the ground is dry, and the temperature above zero, the wind has an enormous force, and we have, as I have said before, had occasion to see the results of its energy.

At *Nasa* wolves were very numerous. As soon as we had left the valley and its ice-sheets, the ground began to rise, and we climbed the slopes of the western hills which were cut through by several small, but deep and tiring, dry watercourses, all going down to the rivulet of *Nasa*. In the principal bed from the pass, there was a good deal of ice. The western hills are all ramifications from the principal range containing the pass, a range which probably is a water-parting between the *Bogtsang-tsangpo* and the *Tang-yung-tsaka*, unless there is another self-contained basin to the north of the last-mentioned lake. Approaching the pass, the ascent becomes very steep. To our left we have the pass-valley with its ice bed, coming from a spring surrounded by good grass. In some of the side valleys there is also some ice. The region is very rich in springs. Finally we reach the

pass, from which the view is magnificent. The red and pink limestone mountains to the north are now going to disappear behind us. Far below us is the *Nasa* valley and just north of it, the little threshold we had crossed the day before. Farther north is the winding course of the *Bogtsang-tsangpo*. Such is the view to the north. The road up to the pass, may be seen on Pan. 101A and 101B, Tab. 17, where the pass saddle is to the S.  $36^{\circ}$  E., and where we get an impression of the range in which it is situated. To the N.  $75^{\circ}$  E., on the same panorama, we see the valley which goes down from *Nasa* to the *Bogtsang-tsangpo*. From the pass I sketched a panorama that is not entered in my *Atlas* as it was already published in Vol. I of my personal narrative »Transhimalaya», p. 297 (Swedish edition). The storm was furious on this height. The country to the south had only partly been seen by Nain Sing, but never by a European. To the S. E. the view is partly hidden by a pink and red rock with steep sides. At a long distance to the S. S. E., a dark mighty mountain mass was rising, with eternal snow-fields, and cut through by deep transverse valleys. Its highest peak was to the S.  $14^{\circ}$  E. and another to the S.  $23^{\circ}$  E. Its form reminded me very much of the *Mus-tagh-ata*. The whole mass, which we perhaps saw in a foreshortened perspective, was very steep to the west and had a gradual slope to the east, where the snow-fields were very extensive. Between S.  $23^{\circ}$  and  $14^{\circ}$  E., there was, at the base of this mountain, a lake of moderate size, situated, as it were, in a deep depression below us. This lake must be the *Tang-yung-tsaka* first mentioned by Nain Sing and entered on his map. Only the northern part of the lake had a blue colour, the rest of it was a dirty red, perhaps from dust and sand, blown thither by the wind and covering the ice. It was impossible to make out the contour lines of the lake, as its eastern and western shores seemed to be hidden.

From *Gyanyak-la*, a valley goes down straight south to the *Lar* valley where *Camp LXXXVIII* is located. To the S.  $5^{\circ}$  E. is a high part or shoulder of the ramifications closing this valley to the west. South of the *Lar* valley there is a range which we would have crossed in a new pass if we had continued to *Tang-yung-tsaka* and *Dangra-yum-tso*. This range stretches east and west like the one we crossed in *Gyanyak-la*. To the S.  $18^{\circ}$  W. is the highest peak of another group, smaller than the first-mentioned one and situated S. W. of the lake. Of the *Dangra-yum-tso* nothing is to be seen, but one has a feeling that it must be situated between the two snow groups just mentioned. To the S.  $36^{\circ}$  W. is a smaller snow peak not so far as the first two. To the S.  $20^{\circ}$  E., we behold the wild narrow valley, which, after having received the little tributary from the pass, just at our *Camp LXXXVIII*, turns to the S. E. and, as mentioned above, probably goes down to the lake; at both sides of this valley wild rugged rocks are rising. The whole scenery to the south is beautiful and fascinating. It is a very accentuated mountainous

country with high relative altitudes, with very steep, sometimes vertical, lines, a quite different landscape from the flat, denudated and levelled *Chang-tang* where the relative altitudes are insignificant and the lines chiefly horizontal. It is as if we already here had a presentiment of the approach of the *Transhimalaya*, with its very accentuated sculpture and its high rocky ranges.

*Gyanyak-la* itself is surrounded by innumerable small peaks, rocks and wild ridges cropping up from enormous masses of débris. Between and at the base of them, springs are often found. Just below the pass, the rocks consisted of greyish red dense Albién-limestone and red and pink dense Barrémien-limestone. On the top of the pass, there is a cairn.

The way down from the pass, that is on the top of a protuberance between two small valleys, which soon join, is very steep. We follow its ice bed, and finally turn to the S. E. until it joins the larger ice valley coming straight from the west. A little higher up in this valley, there are two tents. Just above the point where the joint brook pierces a steep limestone ridge in a very narrow gorge, our camp was pitched. The grass was fairly good but dung was scarce.

Already from the pass, one could guess that the valley going down from *Camp LXXXVII* was very narrow. On *December 14th* I went down some kilometers through this valley and found it to be a very wild gorge between nearly perpendicular mountain walls, as can be seen on Pan. 92, Tab. 15, and consisting of the same Barrémien-limestone as before. So far as I went, or nearly 3 km., it did not change its character and was winding in all directions. At one place it was not quite one meter broad, and here the water is pressed together in the summer. At some places it is nearly closed by blocks and boulders that have fallen down. Still, a path is situated in this gorge. At two narrow passages it leaves the bottom of the gorge and traverses the hills at the sides. At one place the valley is a little wider, and there the grass is good. A travelling nomad had camped here with one or two horses. The whole gorge is a series of the wildest and most picturesque views. At the point where I turned back, the height was 4,798 m. So far as I went, the whole bottom of the valley was filled with ice, and at the narrowest places, there were ice-cascades, as clear as crystal; during the summer there must be small waterfalls. The highest of these cascades was 1.5 m. high. Here and there stones had fallen down on the ice, proving that the destruction of the rocks goes on continuously. Some bends are very sharp around projecting pillars and pyramids. The colour is the usual pink or yellow. Such narrow passages as this, I had never seen on the *Chang-tang* plateau-land. But now we had reached a region that is not far from the peripheric mountain tracts.

The Tibetans we met at *Camp LXXXVII*, gave some information about the roads and names which as usual afterwards proved difficult to identify or control.

The name of the district is *Tang-yung*, pronounced *Dang-yung*. Its northern boundary is *Gyanyak-la*, which here was called *Kam-la*. North of this pass the country was said to belong to *Naktsang*, which stretches a three days' journey to the west, three days to the east and five days to the south, east of *Tang-yung*. The latter district is, during the winter, very scarcely inhabited, as its nomads wander north during the cold season. *Dangra-yum-tso* was said to freeze a month later, *i. e.* in the middle of January, and remains frozen only for a month, which seems unlikely, but, if true, proves that the lake is salt and deep. *Ngangtse-tso* was said to be frozen even now, which proved to be true. The group to the S.  $23^{\circ}$  and  $14^{\circ}$  E., was called *Dungying*, a name that does not agree with later information. The nomads in our neighbourhood mentioned new roads to *Dangra-yum-tso*. The shortest one proceeds from *Camp LXXXVII* to the S. S. W., crossing a pass *Surde-la*, in the first range to the south, after which it passes *Kemra-tangma*, *Nagmo*, *Gukchen*, *Kilung* or *Kelung* and *Ombo* on the lake. A more easterly roundabout road proceeds eastwards from the region of *Camp LXXXVII*, passing *Ngotsang*, *Ngoyung*, *Scriya*, where a chief has his headquarters, *Amlung*, *Serki-tsangri*, the pass *Sha-la*, *Gurmo*, *Samga*, *Chugo* with many tents, *Kemar* near the shore, probably the western, of *Ngangtse-tso*, and from there two days westwards to *Dangra-yum-tso*. *Kemar* was described as a particularly favourable place where grass, fuel and water were good. The second road is about twice as long as the first, but it is more comfortable, and the grass is, as a rule, better. The *Surde-la* was said to be of the same height and character as the *Gyanyak-la*; from its saddle both *Tang-yung-tsaka* and *Dangra-yum-tso* are visible.

On *December 15th* our road goes to the E. N. E. (*Camp LXXXVIII*) for 7.5 km., rising from 4,875 to 5,169 m. or 294 m., at a rate of 1:25.5 m.; the temperature in the night was  $-29.5^{\circ}$ . Leaving the valley of the *Lar*, we ascend slowly in a side valley from the east, in the lower part of which there is ice. At both sides many tributary, gravelly beds come down. The mountains at both sides are, on the whole, comparatively flat, but from their hills of débris, steep, rugged rocks of the same kind as hitherto crop out. A little threshold in this valley has an altitude of 4,893 m., and on its eastern side we go down to a deep valley with steep slopes coming from a wild gorge in the northern range and directed first to the S. E. and then to the S.  $10^{\circ}$  E., passing a rocky corner at its right side where a tent is pitched near a spring. This valley is called *Yupcha*. Just opposite the tent, there enters the valley coming from the next pass on our road, *Pike-la*. The *Yupcha* valley probably joins the *Lar* valley, and is perhaps, lower down, as wild and narrow as the latter is. It cuts through the latitudinal range to the right, or south of our route.

From the little threshold of 4,893 m., we behold the *Pike-la* to the E. N. E., which proves to be of considerable height. However, before reaching it we have to

cross the *Ynpcha* valley. The ground is uncomfortable, uneven due to tussock-grass, pierced by rabbits' holes and crossed by many small, dry watercourses from the northern range. Sometimes heaps of débris are accumulated at the base of these red, pink or yellow mountains. On the eastern side of the transverse valley the ground rises in steep slopes to the *Pike-la*. To the south the pass valley is bounded by a wild and rugged, rocky range, resembling the wall of a fortress. In the rocks, eagles had their nests. *Camp LXXXVIII*, just west of the pass, had the rather considerable altitude of 5,169 m. To the S. W., a plain could be seen, the ground of which was said to be very soft and treacherous in the summer. *Dangra-yum-tso* was not visible, only some of the snow peaks in its neighbourhood. One of them, to the S.  $28^{\circ}$  W., was called *Kelung*; another, to the S.  $50^{\circ}$  W., *Takta-tumsing*. The latter name is doubtful, at least I heard from other nomads farther south, of a *Takta-tomsing* (or *-tumsing*) situated west of our *Camp XCVII*. *Ko-la* and *Dang-yin* were other mountains somewhere near the southern lakes, but impossible to identify. *Targo-gangri* and *Targo-tsangpo* were well known, though the name was pronounced like *Targut*, and the river, which was said to be larger than *Bogtsang-tsangpo*, like *Targut-chu*. The region around our camp was called *Rara*, and the mountain south of it, containing the pass, *Pike-gongni*. *Nyungdok* is a red conical peak, without snow, to the S.  $58^{\circ}$  W., *Lakor-deja* a peak to the S.  $72^{\circ}$  W., and *Nagmo-ri* a flat mountain to the S.  $66^{\circ}$  W. The *Takta-tumsing* and *Kelung* seem to belong to the same, nearly meridional, range.

Regarding the climate, the severe cold would continue for another two months or to the middle of February, after which the winter becomes milder. Usually there is very little snow in the winter, which remains dry; if snow falls, it does so only on the higher mountains.

A little herd of *Ovis ammon* was seen in the high regions of the *Pike-gongni*.

The distance accomplished on *December 16th* was 11 km. We had only 0.6 km. to the pass *Pike-la*, with a height of 5,200 m. The next camp, *LXXXIX*, 10.4 km beyond the pass, at 4,867 m., was thus 333 m. below the pass, and the slope down to it as 1:31. The general direction was E. S. E. The pass is very flat, and is rather a threshold in a latitudinal valley. The valley going down from the pass to the east, soon turns to the S. E., and there is, therefore, no distant view. Nor did the weather allow any observation of the surroundings. After a stormy night, with a temperature of  $-15.1^{\circ}$ , the W. S. W. wind blew furiously during the whole day and some snow fell. Otherwise the view to the S. W. would have been very valuable, if not from the pass, at least from some of the heights in its neighbourhood. The road follows the valley to the east where two steep rocky teeth of the usual limestone, form a beautiful and regular gate by which the pass-brook and the road go down, turning to the S. E. This gate is only about 10 m. broad. The valley is

narrow and wild, between steep rugged cliffs. At a few places there were springs with ice and even some running water. The rocks have the usual pink and yellow colour. At a wide place in the valley, there was a tent. At a broader rocky gate, which on its western side had a steep, projecting rock, another tent was pitched. Through this gate our valley goes out into a latitudinal valley stretching to the S.  $77^{\circ}$  W., in the background of which are hills of moderate size, and at a still greater distance, the snow-covered peaks we had seen before. Our road follows the latitudinal valley to the E. S. E., proving that it is not running quite east and west, but rounded and turning its convexity to the north. To our left, is a series of small irregular peaks. To the south, is a high range covered with fresh snow. In the valley is a dry watercourse, which seemed to fall to the east. Probably there is a threshold farther west, from which the slope goes to the *Tang-yung-tsaka*. *Camp LXXXIX* was placed at the eastern side of a little isolated ridge in the valley.

Our neighbours, in two tents, gave us a few names of the region. The first rocky gate east of *Pike-la* was called *Ngosang*, which also belongs to a part of the valley. *Tarak* and *Sing* were parts of the extensive latitudinal valley; *Poro-nakpo* is a peak to the south of *Camp LXXXIX*. *Tarmartsc-tso* is a little lake just S. E. of the same camp, fed by springs, which also form enormous ice-sheets in the valley; probably not much is left of the lake during the summer. *Ngoyung* is a little tributary valley from the south. *Dova* or *Tova* is a peak, to the east of the upper part of the same valley. *Sabyor* are the mountains N. E. of the camp. *Lungchung* is the place where the two Tibetan tents stood, just west of our camp. The Tibetans reckoned a two days' march to the frontier of the *Naktsang* Province. From *Camp LXXXIX*, Pan. 102<sup>A</sup> and 102<sup>B</sup>, Tab. 18<sup>1</sup>, is sketched showing some of the last-mentioned peaks and groups, and to the E. S. E., the continuation of the latitudinal valley in which we marched the next day.

On *December 17th* we proceed E. S. E. through the latitudinal valley for 9.7 km., descending 108 m. or to 4,759 m. at *Camp XC*, which means at a rate of 1:90. Leaving the camp, we follow the northern shore of the little lake for a while. It forms an isolated basin. Though there was a valley to the N. N. W. from our camp, the Tibetans asserted that no water passed through it to the *Bogtsang-tsangpo*. The latitudinal valley is very regular and runs straight to the east. It is bounded by parallel ranges to the north and south. The stretching from east to west is clearly prevalent in this part of Tibet. We follow the base of the northern range which has the same character as all other limestone mountains in this region, being wild and rugged and of a reddish colour. The range itself, as well as its transverse

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<sup>1</sup> On Pl. 6 of my map a red P is missing at *Camps LXXXIX* and *XC*, indicating that panoramas were drawn from there.



valleys, grow bigger to the east. In the background of the latter, we see another range, not far away, and of the same appearance, but more solid and bulky. This, however, may be the real range, and the rest only ramifications from it. On the other hand, there may easily be two or even more parallel ranges between us and the *Bogtsang-tsangpo*, as we had really crossed three ranges since we left the great latitudinal valley of the river. The *Ngosang* valley came from the crest of the southern-most water-parting range, for the two narrow places in the lower part of the *Ngosang* valley may perhaps indicate smaller parallel ridges or ramifications. One diagonal crossing of these ranges is not sufficient to determine the complicated orography. But the most likely is that there are at least four parallel ranges between *Camp LXXXIX* and the *Bogtsang-tsangpo*. Living rock is visible only along the crest of the range nearest to our left; the whole slope, from its base to the very floor of the large valley, is detritus and débris.

Somewhere just east of *Tarmartse-tso*, we pass a threshold, the existence of which is only noticed by the fact that the view opens up far to the east as soon as we have crossed it. The valley is nearly barren. On its hard soil, scanty gravel is distributed, composed of stones as big as one's fist. To our right, or south of the valley, we observe only one mighty range with a few snow-covered peaks, some of them sharp as before, others more bulky and cupola-shaped. Its colour is dark. From its crest several comparatively large transverse valleys come down. This range seems to be the eastern continuation of the mountains called *Kola* and *Dungying* mentioned above, and situated farther west. The erosion bed of the latitudinal valley is so undecided and shallow that it is difficult to follow. Farther east, where the valley is about 2 km. broad, it seems to fill the whole of its floor. From the southern mountains, many tributaries reach it, every one of them having a fan at its mouth, on which the beds diverge like delta-arms. From the northern mountains, the tributaries do not reach the principal bed, though at some places the base of the scree has been cut off by running water in the main valley.

In the mouth of a tributary valley to the left, there was a lonely tent. The owner, a chief of a small district, was at *Tashi-lunpo*; his servants were watching his large flocks of sheep and yaks, which were driven to the tent in the evening. Our *Camp XC* was pitched at *Neka*, in the middle of the latitudinal valley, where a square wall of earth one foot high had been built, with a fireplace of clay at one side. Over this square, the chief's tent used to be pitched in the summer, so that the wall is inside the tent, and at the same time, as it keeps out draft, may serve as a table for all the different vessels and pots containing milk and tea. At the base of the nearest red hills to the north, a very fine spring of pure water cropped out having a temperature of  $+7.4^{\circ}$ . It forms a miniature pool only 5 m. long from which it continues in a narrow brook; after a short distance, this disappears



WOMAN FROM SIRCHUNG, TRANSHIMALAYA.



below the soil, but again comes to the surface and soon freezes. The water, especially in the pool, contains excellent fish. The name of the spring is *Loma-tseba*. *Choge* is a high mount to the east. *Kung* is a mountainous region of red hills just west of *Choge*. *Sang-chung* is a mountain to the N. E. of the transverse valley, coming down from it and joining the latitudinal valley near *Camp XC*. *Devung*, also pronounced *Tebung*, is a transverse valley to the N. W. *Tana* is a valley S. S. E. *Allok* is a transverse valley parallel to the latter and west of it, both thus coming from the southern mountains. *Ngorcha*, also called *Dongying*, is a snowy peak to the S. E., situated on the high range bordering our valley to the south. *Tag-la* is a pass across the mighty range to the S. W.; it is said to be high and uncomfortable, and the road crossing it is rarely used. When asked in which direction *Dangra-yum-tso* was situated, the Tibetans of *Neka* pointed straight south, and the *Ngangtse-tso* was said to be to the S. 40° E.

The S. W. wind was cold and furious as usual and made all work and every observation very difficult. Of the 96 animals from *Leh*, we had only 12 left, though the Tibetan yaks had saved us.

Pan. 104A and 104B, Tab. 18, from *Neka*, is very instructive and gives us an excellent idea of the plastic aspect of the country. To the N. W. we have the deep-cut *Devung* valley between more or less rocky ridges. To the north is a comparatively mighty part of the northern range, and to the N. E. the rugged cliffs of *Sang-chung*. The mountains N. 62° E., prove to be a rather insignificant ridge. To the east the country is open for a good long way, forming a plain, bounded on the east by the ranges and ridges of *K'ung-lung*. To the S. 22° E. is *Ngorcha* or *Dongying*, and west of it, the deep and accentuated *Tana* valley. The *Allok* valley is also surrounded by rather mighty mountains, and in its background, we behold what may be the crest of the principal range. To the S. 72° W. a transverse valley parallel to those just mentioned, leads up to the pass, *Tag-la*. Due west the country is quite open, and no mountains are visible in the western continuation of the latitudinal valley. The panorama should be carefully compared with the map, Pl. 6. Both combined, give a very clear conception of the landscape, but the panorama is, of course, more realistic, as it shows us everything in sight and in a horizontal view, whereas the map gives us the vertical projection, and shows us the mountains and valleys as they are situated in relation to one another.

In the night, the temperature did not fall below —13.8° and remained high as always, during storms. The next day, the storm was so furious that we could not move. In the morning the sky was fairly clear, but about noon it became troubled by heaps of dust and sand, carried along by the wind. Even fine gravel is brought away and constantly beats against the tents. Light white clouds, standing at right angles to the wind, covered the sky. After midnight the atmosphere

became more quiet and the temperature on the night of December 19th was  $-22.1^{\circ}$ . But at 10 o'clock a. m. the W. S. W. storm again set in with all its fury. The soil in the valley of *Neka*, gave an instructive illustration of the sorting activity of the wind, for it consists only of gravel and coarse sand, whereas all fine material has been blown away long ago. Only such material which is too heavy for the wind, remains. The screes of the surrounding mountains, which begin high up under the crests of living rock, contain nothing but coarse débris. The fine gravel that can be moved by the wind, is only rolled along the ground and does not travel any great distances. Only the fine dust goes with the wind, so far as it continues, which certainly may be over very extensive areas. At places where the soil is moist or where grass is growing, the wind has no power to move even the finest dust, though, of course, corrasion is always active.

On the night of *December 20th*, the storm continued, and went on the whole day, though not quite as severe as before; the temperature being  $-15.9^{\circ}$ . We, therefore, marched 11.2 km. to the E. S. E. rising only 34 m. or to 4,793 m. at *Camp XCI*, being at a rate of 1:329. Disregarding small undulations, the ground, was nearly level.

Proceeding southeastwards we have, to our left, swampy though hard frozen ground of tussock-grass rising on its earth-cones half a meter above the soil. In the summer, the wet ground here is very soft and treacherous; farther east, a little lake is situated in connection with three swamps. Its name was said to be *Tarmartse-tso*, the same as that of the lake at *Camp LXXXIX*. The road follows the base of the southern mountains, and the distance between us and the northern hills increases gradually, so much so that a real plain opens out between the latitudinal ranges. We cross an erosion bed, not far from *Camp XC*, which certainly is the principal bed of the latitudinal valley going to the lake. Then a great number of furrows, from the southern mountains, are crossed; the largest of them being the *Tana* valley. All are filled with gravel. Between the furrows the rabbits' holes are so numerous that one cannot see how there would be space for any more. The rabbits carry on a ploughing work, reminding one of that of the earth-worms; around the openings of their holes, are small heaps of sand and red earth. In this way they assist the wind in its sorting work, for they bring up fine material to the surface which, by and by, is carried away by the storms.

To the south we have the mighty *Ngorcha* or *Dongying' (Dong-yin)* Group with its snow-covered peak. From this mass, some large transverse valleys come down, breaking through the lower reddish ridges situated N. E. of the culminating group, and easily recognizable on the panorama from *Camp XC*. At one place, springs come out at the base of the mountains, forming large ice-sheets resembling a little lake. This region is called *Seriya*. Here the living rock is reddish white limestone,

very weathered and rotten. A large sheepfold of stone was erected near the spring. The latitudinal valley slopes very slowly to the east, and the transverse valleys are directed to the N. E. and N. 60° E. At the openings of several small valleys, there are ice-sheets from the springs. *Camp XCI* was erected near the mouth of a larger transverse valley containing springs with open water, ice and good grass. Here the living rock was greenish grey sandstone. The name of the place, including the region to the east, was *Kunglung*. Continuing south from *Camp XCI*, a road crosses the great range in a pass, which was said to be too high for our tired animals, so we were advised to continue a bit eastwards and S. E. to *Sarya-la*, which was easier and which leads to a district called *Nadsum*. The frontier between *Tang-yung* and *Naktsang* was said to be at *Seriya*, about halfway on the day's march.

To the E. N. E., a lake was in sight. Its name was given as *Kung-tso*. Around it were said to be some tents of the *Naktsang* nomads. To the N. E. from our camp, there also seemed to be a lake, at least extensive ice-fields and some open water were seen in that direction along the foot of the northern hills. One gets the impression that the latitudinal valley, which here in the east becomes as broad as a plain, is a geographical analogy to the valley of the *Bogtsang-tsangpo*, thus sloping to the east, and having a principal, now dry, watercourse falling into the *Kung-tso*. This conclusion also seemed confirmed by the N. E. course of the southern tributaries. But our Tibetan guides asserted that this was not the case. There was no principal watercourse and no lake that could be compared with the *Dagtse-tso* as a general recipient of the whole latitudinal valley. The larger bed we had seen at *Camp XC*, does not reach the *Kung-tso*. There were general small depressions on the plain, independent of each other, and containing some water in the summer. Now, in how far this is correct is difficult to say, as the Tibetan views of physical geography are not quite reliable.

From *Camp XCI*, Pan. 103A and 103B, Tab. 18, was sketched, so far as a distant view was allowed, for just behind us, we had the rocks and slopes of the *Dungying* Range hiding everything to the south and S. W. To the N. 45° and 40° W. we have the ridges and peaks of *Sang-chung*. To the N. 16° W. is *Porteng*, a fairly high mountain. To the N. 12° W. is the pass *Kanda-la*, and a little to the left or west of it the *Shamda-la*, both with roads to the valley of the *Bogtsang-tsangpo*. In the same direction and at a considerable distance, there is a high mountain-mass with snow. To the N. 3° E. is a pass valley called *Yaklung*, pronounced *Yaglung*, with an easy road to *Bogtsang-tsangpo*. To the N. 40° E., is a region, *Kongo* or *Kon-go*. Just to the right of the latter, or N. 41° E. is a ridge *Keva*, high and of a red colour, at the northern foot of which the latitudinal valley of the *Bogtsang-tsangpo* was said to be situated, without any parallel valleys between.

*Dagtse-tso* was said to be to the N.  $45^{\circ}$  E. from the camp, and could be reached in two days on horseback. To the N.  $28^{\circ}$  E., a region called *Murtsang* with a lonely tent, was visible. Below this region, were the extensive ice-sheets mentioned above and shown on the map. The northern mountains are coloured in reddish, pink, yellowish, violet or light greyish tints; these colours being most pronounced where the rock is solid, and more undecided in the screes and fans. One has to deal with several parallel ridges and flat peaks. Lowest down, there are hills of débris, above them small ridges pierced by transverse valleys, and above this, a very irregular and deformed system the main range of which culminates in *Keva*. This range is thus the water-parting between *Bogtsang-tsangpo* and the *Kunglung* plain, and between the *Dagtse-tso* and *Kung-tso*. The range bounding our latitudinal valley to the south, had been continuous all the way from the valley of *Ngosang*, but I could not tell how far it continues to the west. In the east it seems soon to come to an end. At *Camp XCI* we were only a two days' march south of my route of 1901.

Our remaining road to *Ngangtse-tso* was now said to pass by *Nadsum*, *Sumju*, *Shala*, *Gurmo*, *Chugo* and *Kemar*, or six days distance. Some of the names were never found, but the distance calculated according to the speed of yaks, was correct. The district *Kemar* was not found here, though it may be situated at the western or S. W. shore of *Ngangtse-tso*. I had spoken of the desirability of staying for some weeks of the coldest time at some favourable place, and the Tibetans had proposed *Kemar*. But now they said it would be much better to continue to *Kovo*, a village with stone huts and cultivated ground, where everything could be obtained at very moderate prices. On horseback, *Kovo* would be 5 days from *Kemar*, but we would need 9 days with our yaks. By taking this road, we would have to camp at the following places reckoned from *Kemar*: *Natamchen*, *Gyangtse*, *Kuramti*, *Dopcha*, *Tingdang*, a high pass, and *Dorsang*, *Kamso-tangma*, *Mangse-sumdo* and *Kovo*, which is the first permanent village on the way to *Shigatse*. On this occasion, neither I nor any other European had ever heard the name *Kovo*, so I did not pay more attention to it than to other unknown names mentioned to me by the Tibetans. Later on, or on *April 18th*, 1907, I would however, have my *Camp CXLIV* at this village, the name of which is better written *Govo*, situated on the *Pachu-tsangpo*. The information in this particular point was, therefore, perfectly correct. When returning north in April, *Govo* was indeed the last permanent village I passed. But the distance is greater than 9 of our ordinary marches. The pass mentioned by the Tibetans, may be *Chang-la-Pod-la* in the *Pabla* Range of the *Transhimalaya*. But it may as well be some other pass on the road. The fact that the other names mentioned above, were not heard by me in April, only shows that there is a road across the ranges of the northern *Transhimalaya* from *Ngangtse-tso* to *Govo* which is absolutely unknown.

Of *Shuru-tso*, I now heard for the first time; it was shown as being situated to the S.  $45^{\circ}$  W., though it is S. S. W. of our *Camp XCI*. I understood it must be the same lake which Nain Sing had heard of and called *Siru-tso*. From *Kemar*, our informant knew only one road to *Shigatse*, though three existed; the western and eastern, he had not travelled, but the one in the middle, which was the best and the nearest, he knew. It was said to pass by *Natamchen* and *Gyangtse*, mentioned above, *Tsigor*, *Sebseb*, a pass, *Lumsang*, *Nagma-chu*, a large river that even now is open, and in summer is 1 m. deep; from there the *Targo* Mountains are visible and may be reached in one day on horseback; then *Nagma-churu*, *Busikibyang*, *Lingyu*, *Targo-tsangpo*, coming from the *Targo* Mountains and corresponding to Nain Sing's *Dumphu*. *Targo* is here pronounced as *Targut*. Then the valley of *Targo-tsangpo* is followed *viâ* *Tarok*, *Leh-nakting*, *Ladya* and *Tuba-la*, after which one arrives at *Tangne*, with a cornice-road and a little lake called *Shung-tso*; then *Kokyu*, *Shungtang*, *Shungok*, with a little pass, *Dangdo*, with a high pass called *Shovo-la*, *Sarokting*, *Yarung-pikya*, a village with stone huts and cultivated ground; *Keme*, *Rudok-song*, *Na-keyu*, *Namling-song*, well-known on our maps and four days from *Shigatse*. Our informant left the latter town alone, and passed by *Nang-la*, the village *Saulung*, *Ngo*, *Nga-lagang*, *Parka*, *Nebyi*, *Chungar*, where the *Tsangpo* is crossed, *Latse*, *Gyanglep*, a village, and *Sakya-tumyu*, to the famous monastery of *Sakya*. A few of these names may be identified, but most of them are unknown to us. So much is certain: that many routes cross the *Transhimalaya* in different directions, which have to be explored in the future.

On our arrival at *Camp XCI*, a Tibetan caravan was seen approaching the same place from the east. It consisted of a few men on horseback driving 12 ponies and 100 sheep loaded with barley and roasted meal or *tsamba* which had been bought somewhere farther south and payed for with salt. Now the caravan was on its way to the *Bogtsang-tsangpo*, where the men had their homes, belonging to the *Naktsang* province. The provisions would be sufficient for the winter when distributed among several other tents, the rest of their food consisting of milk and the flesh of wild yaks or, if game is scarce, the flesh of sheep.

On the plain north of the camp several antelopes were seen, both *Pantholops hodgsoni* and *Gazella picticaudata*, in small herds or two and three together. Wolves were also seen in our neighbourhood.

On *December 21th*, we made 9.7 km. to the S. E. crossing the *Dongying* Range in the pass *Sarya-la*. To the latter we had 5.8 km.; the altitude of the pass is at 4,865 m. or 72 m. above *Camp XCI*, the rise, therefore, being very gradual and comfortable, or as 1:81. On the south side, we had 3.9 km. to *Camp XCII* where the height is 4,805 m., being a fall of 60 m., or as 1:65. From the figures given,



a profile may be sketched of this section, showing how extremely flat the range is at the line where we crossed it.

All night and all day the storm continued with the greatest fury, and the temperature had only been at  $-14.1^{\circ}$ . From the camp we had, in the morning, an excellent opportunity to study the action of the wind over the extensive plain and the mountains to the north. Especially to the N. E., large compact clouds of red dust were swept from the ground and sailed up the slopes of the mountains around mount *Keva*, which now and again disappeared. These red clouds seemed to rise to a considerable altitude above the highest crests of the mountains and then to disappear beyond them continuing their journey, God knows how far. At other places where the northern mountains were yellow, the clouds of dust had a yellowish tint. From the ground of the plain small clouds of grey dust were ploughed and whirled up by the tremendous force of the wind, but seemed to rise less high than the red and yellow clouds. As the strongest and most constant winds in high Tibet come from the S. W. and W. S. W., the sides of the mountains directly exposed to the wind, are more carved out by corrasion, and all the fine material existing is swept away. On the lee sides, the action of the prevailing wind is less energetic. This fact plays a certain part in the weathering as I have tried to explain in my *Scientific Results*.

On the left bank of the watercourse of *Camp XCI*, a *mani-rigmo* was standing. Leaving it we marched east and E. S. E., crossing some fairly deep-cut valleys with ice, and slowly ascended in the direction of the pass, which by and by turned to the S. E. and south. To the east a labyrinth of hills is seen with numerous small valleys going to the central parts of the large plain. The rock was yellowish white and light reddish chalk-limestone. Crossing innumerable small erosion furrows, we finally go up to the little pass of *Sarya-la*, a flat and comfortable saddle of greenish grey sandstone. Pan. 108, Tab. 19, shows the view to the south from the pass.

The valley going down from the pass, is at first directed to the E. S. E. and receives several branches from the trough to the west of the road, which must all be crossed. Here two tents and some sheepfolds were passed, as usual, placed as much as possible to the lee side of the prevailing S. W. wind. The convex part of the stone-folds for the sheep, therefore, was directed to the S. W. The pass valley runs to the S. E. and our road goes south over slopes consisting of hard yellow clay and dust, with grass. To the west we see the rocky range we have just traversed in the *Sarya-la*. Not very far eastwards this range seems to come to an end. From its eastern part, some erosion beds go down to the plain east of *Camp XCII*. This camp was pitched at the base of hills giving some lee from the wind. There was the ice-sheet of a spring. Grass and fuel was found at some distance. In the neighbourhood, were two Tibetan tents. It is impossible to describe

such a ride in the rarefied air, the biting cold and the killing wind, especially when riding against it as during the latter part of the day's march. It is very difficult to use one's hands, one is nearly blown from the horse's back, the map plane cannot be used and I have to make a rough sketch in a little book. The marches have to be made very short, for one has a feeling that one could not keep one's blood circulating for another two or three miles. Arriving at camp, one is half dead, and must pass about an hour at the fire to be able to sketch the usual panorama. It is not advisable to travel through high Tibet during the winter.

The place where *Camp XCII* was pitched, is called *Korumteomal*, and the plain east of it, *Nadsum*. The mountains to the N. W. and N. N. W. were called *Dongying-tip*, or perhaps, better, *Dongjing*. These mountains are easily seen on Panorama 105A and 105B, Tab. 19, taken from *Camp XCII*. From this camp we see that the range of *Dongying* really dwindles to nothing, east of *Sarya-la*, for mount *Keva* is still visible to the N.  $23^{\circ}$  E. The hilly region to the N. E., is *Nadsum-sherke*, situated north of lake *Kung-tso*, and S. W. of the same; it seems to be a common name for the moderate hills of *Kung-lung*. When the Tibetans of *Nadsum* told us that across the region of *Nadsum-sherke*, or N.  $38^{\circ}$  E., there was a road passing a lake *Goang-tso* and continuing to *Bogtsang-tsangpo*, one feels tempted to believe that this *Goang-tso* is the same as the *Kung-tso*, though there may, of course, also be two lakes. When we asked where *Dagtse-tso* was, they pointed to the N.  $40^{\circ}$  E., which was about right. To the N.  $67^{\circ}$  E., the mountainous region was called *Tsomo-Kunglung*, to the N.  $82^{\circ}$  E., is a double peak called *Choge*, entered without a name on the panorama. To the N.  $88^{\circ}$  E., is the region of *Bogar-ngoyung* with mountains of the same name. To the S.  $80^{\circ}$  E., the country seems lower, and there is the valley of *Bogar-ngoyung* with a road leading to *Shansa-dsong* on the *Kyaring-tso*. To the S.  $70^{\circ}$  E., is a comparatively high mountain, *Changa* or *Chaga*, and S.  $58^{\circ}$  E. the high peak, *Chaga-pungnak*. To the S.  $3^{\circ}$  E. is the continuation of our road with a pyramidal peak at its side; there is said to be a pass *Chebuk-la*, which we never heard of later on. To the S.  $12^{\circ}$  W., a road was said to pass to a place called *Latse-dsong* which should not be confounded with the village of that name on the *Tsangpo*. It may perhaps be a place near the *Dangra-yum-tso*. Most of these names we had heard before from other native sources, and, therefore, they may be regarded as reliable.

On *December 22th*, our march goes S. S. W. for 9.4 km., rising 66 m. or at a rate of 1:142, *Camp XCIII* being at a height of 4,871 m. Even if the country is full of mountains, we thus find that the plateau-land character, at least along the road, is very pronounced. After a temperature of  $-19.6^{\circ}$  in the night, the storm again set in at 9 o'clock a. m., and we had it nearly straight in the face during the march. We now cross a broad, but as it seems, not very long latitudinal

valley, which on the west is bounded by the mountains on the eastern shore of *Tang-yung-tsaka* and on the east by different ranges and peaks of *Naktsang*. Just west of our road, the floor of this latitudinal valley has flat undulations which we partly cross. Reaching the highest point of this flat elevation, at 4,817 m., we behold to the S. W. a range of pointed pyramidal peaks at no great distance and obviously the western continuation of the one we crossed in *Lamlung-la*, two days later. At some places this range has snow on its northern side; at the southern, which is directly exposed to the sun, there may be no, or very little snow. The range is probably an important water-parting of the region of lakes south of it. At about two days' distance to the west, the mountains of *Dongying* and those of *Lamlung-la* seem to be in connection with one another, the *Serki-yari* meridional range joining them, though this question is difficult to decide at such a long distance. In the last-mentioned range there is, at any rate, a practicable pass, as a road is said to connect the region of *Camp XCIII* with the *Tang-yung-tsaka*. The *Serki-yari* Range was said to be the frontier between *Tang-yung* and *Naktsang*. South of the same pass, rises a considerable cupola-shaped peak with extensive snow-fields. In the country between my route and the *Serki-yari* Range, there are said to be several roads from north to south, ascending transverse valleys in the mighty range of *Lamlung-la*, and crossing it to the country between *Dangra-yum-tso* and *Ngangtse-tso*.

The ice-sheet from a spring is crossed; it comes from the N. W. through a little valley, surrounded by soft hills overgrown with grass. There is also much moss in the region, forming small hemispherical hummocks 5 cm. high and about 15 cm. across. Rabbits' holes are passed, in belts or zones. After crossing a new protuberance of the soil, we go steeply down to the broad valley of the rivulet *Sertsang-chu* flowing to the E. N. E. in a gravelly bed, and having erosion terraces on both sides. Under the concave ice-sheet in the deepest part of its bed, even now there flowed about 1 cub. m. per second, and in the summer there was said to be a good deal of water. The volume of water had diminished considerably since the ice formed. It proved to be impossible to get reliable information about the origin and the end of this little river. The Tibetans only said it came from the mountains in the west. One old man said it went to *Dagtse-tso*. On my journey in 1901, I did not see any such tributary from the south or S. W., but I travelled a certain distance north of the *Bogtsang-tsangpo*, and can, therefore, not tell whether the information is true or not. Judging from the appearance of the country, it would be more likely that the river goes to *Kung-tso*. The form of the bed shows, anyhow, that very much water occasionally comes down. On the right terrace a little *mani* is built. After crossing another flat hill, we come down to a little depression with a spring and grass, and at the height of 4,871 m. South of our *Camp XCIII*,



TIBETANS OF TRANS-HIMALAYA.





FÍFEÁN FROM GARGANSA





TRAVELLING TIBETANS







GROUPS OF NATIVES, TRANSHIMALAYA.



were three Tibetan tents and sheepfolds. The inhabitants complained of having lost a large part of their flocks from some disease. The name of the place was given as *Sumju*.

Panorama 106A and 106B, Tab. 19, is very instructive as it again gives a much better representation of the high mountains to the S. W. than could be given in words. The dark range to the E. N. E. was called *Keva-tamchuk*. To the S.  $83^{\circ}$  E., was *Changa*, which was in accordance with earlier information. Such was also the case with *Chaga* or *Chaga-pungnak*. The valley to the S. S. E. which we had to follow the next day, they called *Tebuk*. Continuing in it to the south, we would in two days cross a pass called *Gurtse-la*. As it came out, we left this pass and its valley to our right and continued to the *Lamlung-la*, situated more to the east. The *Gurtse-la* is, however, a pass of the same orographical rank as the *Lamlung-la* and is situated in the same southern range stretching east and west. West of *Gurtse-la* is still another pass in the same range, called *Sha-la*. Another tributary valley leads up to it, probably starting from somewhere about *Camp XCIV*. The road the Tibetans of *Sumju* proposed to us, would, therefore, take us to *Tomochapko*, the *Gurtse* valley, *Gurtse-la*, and on its southern side, to *Gurmu-hlarang*, from where we would reach *Ngangtse-tso* and *Kemar*. Thence we could continue through a place called *Samga*, to *Latse-dsong*.

Returning to the panorama we find a series of high pyramidal peaks beginning from S.  $13^{\circ}$  W. and stretching the whole way to N.  $75^{\circ}$  W. The peaks from S.  $85^{\circ}$  W. to N.  $75^{\circ}$  W. may, however, belong to another range, as they seem to be situated much nearer to us than the peaks which come to an end at about S.  $75^{\circ}$  W. From the map, Pl. 6, one gets the impression that the *Serki-yari* is a nearly meridional range stretching along the eastern shore of *Tang-yung-tsaka*, whereas the range, with the passes *Lamlung-la* and *Gurtse-la*, seems to stretch east and west, or nearly at right angles to the *Serki-yari*. It is, of course, impossible to make out the orography at such a great distance. But it may be that the two ranges just mentioned are in reality only one, and that the *Serki-yari* by and by turns to the S. E., E. S. E. and east, forming a semi-circle, turning its convexity to the *Dangrayum-tso*. Some informants called the western mountains *Serka*. The different peaks had no special names. The highest peaks to the north, belonging to the range we had crossed in *Sarya-la*, were called *Ngorcha*, and were now visible to the N.  $49^{\circ}$  W. and N.  $30^{\circ}$  W. The names agreed with those we had obtained before. But as a rule the Tibetans are not always reliable in their information. Thus the *Dagtse-tso* was pointed out as being situated to the N.  $5^{\circ}$  E. though it is situated to the N. E. A seven days' march was said to separate us from *Govo* and one month from *Shigatse*. As to the *Sertsang-chu*, the most probable conclusion is that it comes to an end in a self-contained basin somewhere to the N. E., and that the erosion beds from *Sarya-la*, which were directed to the S. E., go to the same depression.

Already from *Camp XCII*, we had begun to rise very slowly in the direction of the next latitudinal range. On *December 23rd*, the ascent continued at the same slow rate. The distance was 10 km. to the S. E. and the absolute altitude of *Camp XCIV* is 4,932 m. or 61 m. higher than at *Camp XCIII*; this gives a rate of only 1:164, which is even more gradual than the previous day, or 1:142.

The S. W. wind continued as strong as before, and the temperature of the night was  $-18.2^{\circ}$ .

The road follows along the base of the western hills where tussock-grass grows and where the ground, in the summer, is swampy. Small valleys open from the S. W. and turn N.  $75^{\circ}$  E. so far as one can see. They are probably bound to the same depression as the *Sertsang-chu*. Three of them contained ice. Flocks of sheep and yaks are grazing here and there. After having passed the undulating slopes of the hill-base, we go down to even ground, or rather to the entrance of a valley where two tents and some sheepfolds stand near the left side of a bed filled with ice, and stretching a rather long way to the N. N. E. across the plain. To our right we now have the gentle slopes of the western hills pierced by millions of rabbits' holes; it nearly seems as if these small rodents, just like the nomads, preferred the lee sides of the hills. To our left we have a long swamp with ice-sheets between tussock-grass, and formed by the watercourses from the upper parts of the valley. Three more tents were passed before we reached *Camp XCIV*, situated at the point where a tributary comes in from the S. W. Large flocks of sheep were seen in the region. The name of the place is *Tomo-shapko*.<sup>1</sup> The rock is yellowish white chalk-limestone. The valley is open, but not very broad, and surrounded mostly by soft rounded hills. At such a place a panorama would not show very much. The Tibetans of this place were unfriendly and would not give any kind of information, nor sell milk or sheep, which at other camps had been easy to obtain. It was cold and the storm was severe; sometimes one cannot understand how it is possible that men can live in this inhospitable country.

The march of *December 24th* goes, as a whole, to the S. E. and is 18.6 km. in length. From *Camp XCIV*, we had 14.5 km. to *Lamlung-la* which is 5,179 m. high or 247 m. above the last camp, the ascent thus being at a rate of 1:59. On the southern side of the range, the slope is much steeper or a 351 m. fall in 4.1 km.; *Camp XCV* being at a height of 4,828 m.; the rate of slope is here, therefore, as 1:11.7.

The wind stopped at midnight, the lowest temperature was  $-18.4^{\circ}$ , and we had good weather the whole day.

Just above *Camp XCIV* the rock at the right side of the valley was greyish yellow sandstone and greyish yellow and red Barrémien-limestone. Just south of

<sup>1</sup> On the map erroneously *chapko*.

*Lamlung-la* we had brownish grey quartzitic sandstone or quartzite. On the slopes, down to the camp, the living rock consisted of dark grey phyllitic argillaceous schist.

A short distance above *Tomo-shapko*, the springs and frozen swamps come to an end; the springs situated highest up in the valley were the most abundant and formed very extensive ice-sheets. Here two *manis* have been built, the biggest being 7 m. in length. The valley there is dry, even without ice. The ground is hard, covered with fine gravel, and partly free from rabbits' holes. The hills on both sides are rounded soft ramifications from the range, and hard rock is seldom seen. Most of the side valleys are small and short, only two or three reaching far into the range. The bed of the principal watercourse in the valley is very shallow, only 5 or 10 m. broad, and its erosion terraces are not much worked out by running water. As a rule there are no signs of energetic water action, though it seems that a great deal of water ought to come down after heavy rains. But perhaps the greater part sinks into the ground, and lower down, reappears in form of the extensive springs and swamps we had passed.

At the point where the valleys from *Gurtse-la* and *Lamlung-la* meet, two tents and several sheepfolds were passed. Our guide took us to the latter valley, though the *Gurtse-la* road, which had been recommended by the Tibetans of *Sumja*, probably would have been both easier and shorter. On the eastern road we had the opportunity to discover the depression of *Dumbok-tso*; on the western road we would perhaps have discovered some other depression. Still we had nothing to complain of, for the road taken proved to be interesting.

Ascending at a moderate rate, we suddenly found ourselves on the flat platform of *Lamlung-la*; there is no sign of a road and no cairn, which made it still more likely that the most frequented road goes past *Gurtse-la*. There is no distant view at all from this pass, as it is hidden by rounded hills in the immediate vicinity, as shown on Pan. 100, Tab. 17. The valley that goes down on the other side, to the S. 55° E., is rather narrow and very steep, and we preferred to continue to the S. E. across the hills, thus reaching a second flat pass of the same height as *Lamlung-la* and being of secondary importance. From here the view was both surprising and interesting. It is seen on Pan. 111, Tab. 20. From N. 15° E. to S. 10° E., there is a semi-circle of considerable mountains, among which the *Chaga-pungnak* Peaks to the E. N. E., are the highest. Inside this ring of mountains is a depression, to the western edge of which our hills fall steeply down with their gravelly slopes, finally forming a barren plain of gravel, across which several dry watercourses wind their way down to a little lake called *Dumbok-tso*. In the middle of the depression there is a little isolated ridge, rocky and picturesquely modelled by weathering and erosion. Its name is *Tso-ri*, or the »mount of the lake«. To the S. W., from *Tso-ri*, a neck of land connects the isolated mount with the last ramifications from

the hills on which we stand. On both sides of this neck, semi-circular beach-lines are well marked, showing either a general and constant desiccation or a seasonal fluctuation of the water-level. For it seems likely that after rains, the different, now separated, parts of the depression join in one lake. The greater part of the lake bed now seemed to be dry; its surface was white as snow; but at some places along the shores, blue ice-sheets were visible crossed by white cracks. The N. W. part of the depression formed, as it were, a separate little lake, the *Dumbok-tso*. The name is not quite certain, for other Tibetans called the lake *Pul-tso* (*Pool-tso*), a name indicating that it is salt. The eastern mountains form, as is well seen on the panorama III, a compact block, in the sides of which there are innumerable small and steep erosion valleys. In the mouth of nearly every one of them, is a fan, and on their surfaces the branches of the watercourses diverge like the arms of a delta. To the S. E. and S. S. E., there are also high mountains with valleys opening to the depression, but without snow on their rounded peaks. South or S. W. of the southern part of the lake, one does not see, but suspects the existence of a plain. *Tso-ri* gives a characteristic aspect to this lake basin, and it seems not unlikely that this depression, when filled with water after heavy and constant rains, may assume the same curious annular shape as *Naktsong-tso* of my journey in 1901, and of *Yamdok-tso* south of the *Tsangpo*. Under such conditions the little neck of land connecting the *Tso-ri* with the mainland, may be flooded.

The slope down from the second pass, seemed to be endless. Marching S. E., we had a deep-cut valley with ice to our right, and finally we crossed it. Among the hills at its left side, there was a tent. Then followed a steep slope, and finally we descended gradually on the undulating ground which slowly goes over into the plain or floor of the depression. *Camp XCV* was placed at the lee side of the ridge that bounded the last-mentioned valley to the west. The grass was not of the best, dung and ice were to be had, but no running water.

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## CHAPTER XII.

### TO NGANGTSE-TSO.

The region about *Camp XCV*, was called *Kachen*. Four tents were said to exist in the immediate neighbourhood; one of these was in sight, and two were situated at *Yerke*, a place at the opening of the steep valley, coming down from *Lamlung-la*. The Tibetans of the place, gave the same name to this pass and to *Gurtse-la* as we had heard before. The names *Dumbok-tso* and *Pul-tso* were also checked, and it may be that the two appellations signify different parts of the depression. One old Tibetan called the whole lake *Dumbo-fu-tso*, which simply is an amalgamation of both names. They confirmed that the lake is salt, but frozen, and asserted that, even in summer, it gets larger than now, which is, however, doubtful. The high peak to the N. E. was called *Chaga* as before. The nomads of *Dumbok-tso* pass the winter around the lake, and wander, during the summer, to the *Chang*, i. e. the northern country in contradistinction from the nomads of *Bogtsang-tsangpo* who wander north in the winter. The cold as well as the S. W. wind, would continue for another six months. In the summer the wind is less regular. To *Ngangtse-tso*, they reckoned two days, and to *Kemar* three. *Dangra-yum-tso* was pointed out as being situated straight west, but when they asserted that the *Tsikut-tso*, Nain Sing's *Chikut-tso*, was situated to the N. 20° E. they were probably mistaken. The real geographical position of this lake, however, remains to be determined. The province of *Naktsang* was said to stretch another five days to the south, after which follows the province of *Labrang* or *Tashi-lunpo*. The principal place of *Naktsang* again was said to be *Shansa-dsong*, south of *Kyaring-tso*. Regarding the lakes, another informant told us that *Tsikut-tso* was nine days distant, if travelling with yaks. The lake east of *Ngangtse-tso*, they called *Marja-tso*, though *Marchar* was the name given later on. The *Daru-tso* of Nain Sing, nobody had heard of, nor anybody else among the nomads we had hitherto asked. When they said a lake *Staruk-tso* was situated somewhere to the north, I think they meant *Tarok-tso*, which is, in fact, situated to the west; but certainly the nomads of *Dumbok-tso* had never had any reason to visit that region, as their wanderings chiefly seem to take place



in a meridional direction. On our road to *Ngangtse-tso*, we had to cross two passes, *Gyanglam-la* and *Laen-la*, the latter also pronounced *Laë-la*. The customary road to *Shigatse*, passes just east of the lake. *Ngangtse-tso* was said to be larger than *Dangra-yum-tso*, information that was not in accordance with what I saw and heard later on at the *Targo-tsangpo*. They reckoned the *Ngangtse-tso* to be three days long, and six or seven days around, if travelling with yaks. From west to east and *vice versa*, one could not see the opposite shore — an obvious exaggeration.

From *Camp XCV*, Pan. 112, Tab. 20, was taken, which is very much like the one from the second pass, Pan. 111, though both the vertical and the horizontal angles, of course, have changed a little. In this new perspective, the snow-covered *Chaga Peak* assumes a more dominating appearance.

On *December 26th* our march was 11 km. S. S. E. Both end-points of the march had about the same height. *Camp XCV* being 4,828 m., and *Camp XCVI* 4,824 m. high. Two passes were crossed, the *Gyanglam-la*, having an altitude of 4,922 m., and the *Laen-la* of 4,933 m. Near *Camp XCV* we cross a valley from the west, and a series of small erosion beds. They all join in a watercourse piercing the small hills to our left. In an open valley, we approach the first pass. Just before reaching it, Pan. 110, Tab. 19, was sketched, again showing the *Dumbok-tso*, the *Tso-ri* and some of the surrounding mountains. To the N. 17° E., we now see the mouth of a valley, through which, in summer, a good deal of water was said to come down to the lake; this river was called *Damrap-chu*. From *Gyanglam-la* we had, to the S. S. E., a semi-circular trough surrounded by mountains from which many watercourses, some of them joining one another, go down to the lake, all dry now and even without ice. On the plain at the base of these hills, were numerous herds of kyangs and *Gazella*-antelopes, as well as hare. Only two tents were passed in a valley to our right.

With hills on both sides, we follow the erosion valley of the pass down to the plain, where the height is 4,791 m. At some places this erosion bed is cañon-shaped, being less than 2 m. broad and 3 m. deep with perpendicular or even overhanging sides. The rock is sandstone. At four places we passed living rock. The first was just north of *Gyanglam-la*, being greenish grey sandstone schist. The second some kilometers farther on, being white quartzitic sandstone or quartzite with brown patches, and the third, near *Laen-la*, being greyish green sandy schist. Here the road turns to the S. W. and we follow a shallow valley to the pass, *Laen-la*, a flat easy threshold where dark grey hard and calcareous phyllitic argillaceous schist crops up at both sides of the saddle. One kilometer N. E. of *Laen-la*, Panorama 107, Tab. 19, was sketched. From here, the *Dumbok-tso* proper cannot be seen, but a large part of the even white floor of the depression is visible as well as most of the *Tso-ri*. The *Chaga Peak* has nearly the same pyramidal shape as on the last

two panoramas Nr. 111 and 112. As the *Lamlung-la* is a water-parting between the depression of *Nadsum* and that of *Dumbok-tso*, so the *Laen-la* is a water-parting between the *Dumbok-tso* and the *Ngangtse-tso*. The *Gyanglam-la*, on the other hand, has no water-parting importance whatever. From *Laen-la*, the *Ngangtse-tso* is not yet visible, but we suspect a large lake depression to the S. W., for in this direction, there is an interruption between the mountains, and only far away there is a rim of hills of a light blue colour. Only in these two directions, there is a distant view. The rest of the horizon is hidden by rounded hills belonging to our immediate vicinity. The colour of the mountains is dirty and undecided.

On the southern side we go down to the upper part of a broad, open and flat valley with grass and springs on all sides, bounded by hills and opening out to the northern-most part of *Ngangtse-tso*.

The nomads of *Camp XCVI* confirmed the name of the place being *Laen* and the pass above it, *Laen-la*. The name of the large lake was pronounced *Ngangsi-tso*. One day and a half to the east, was a place called *Markung*, where nomads lived. To *Kemar*, two days were reckoned. *Targo-gangri*, here called *Torgut*,<sup>1</sup> was well-known and regarded as sacred. When travellers get the first glimpse of it, they fall down on the ground and worship it. A ridge to the S. E., only a few kilometers distant, was called *Gyabsang*, and the hills to the west, *Kelam*. The mountains bounding the valley of *Laen* to the west, were called *Kyedsö*. In the *Laen* valley, five tents were now pitched. The *Naktsang* Province continued four days more to the south, after which follows the territory of *Tashi-lunpo*, which agreed with earlier information. An old Tibetan, who was our neighbour, was the owner of 100 sheep and 6 yaks. He was accustomed to passing the winter in different valleys in the vicinity; in the summer he goes down to the lake. He said there were several tents along the southern shore of the lake, but only a few along the northern. He distinguished between good and bad wind-years. The good were such when the wind was not strong and came to an end comparatively early in the spring.

It was our intention to pass some two or three weeks on the shores of *Ngangtse-tso*, to let our yaks and last ponies have a much needed rest at a place with good grass. Such a place was found at *Camp XCVII* to which we moved on *December 27th*, after a night with no wind and a temperature of  $-31.2^{\circ}$ . We thus followed the base of the eastern mountains to the S. S. W. for 4.5 km., descending 54 m. or at a rate of 1:83, as the next camp, *XCVII*, had a height of 4,770 m. To our right, we had tussock-grass and sheets of ice formed by springs.

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<sup>1</sup> Nain Sing has *Targot Lha* Snowy Peaks and *Targot Sangpo*. This may be right, though in the vicinity of the mountain and at the river I heard the name pronounced *Targo*.

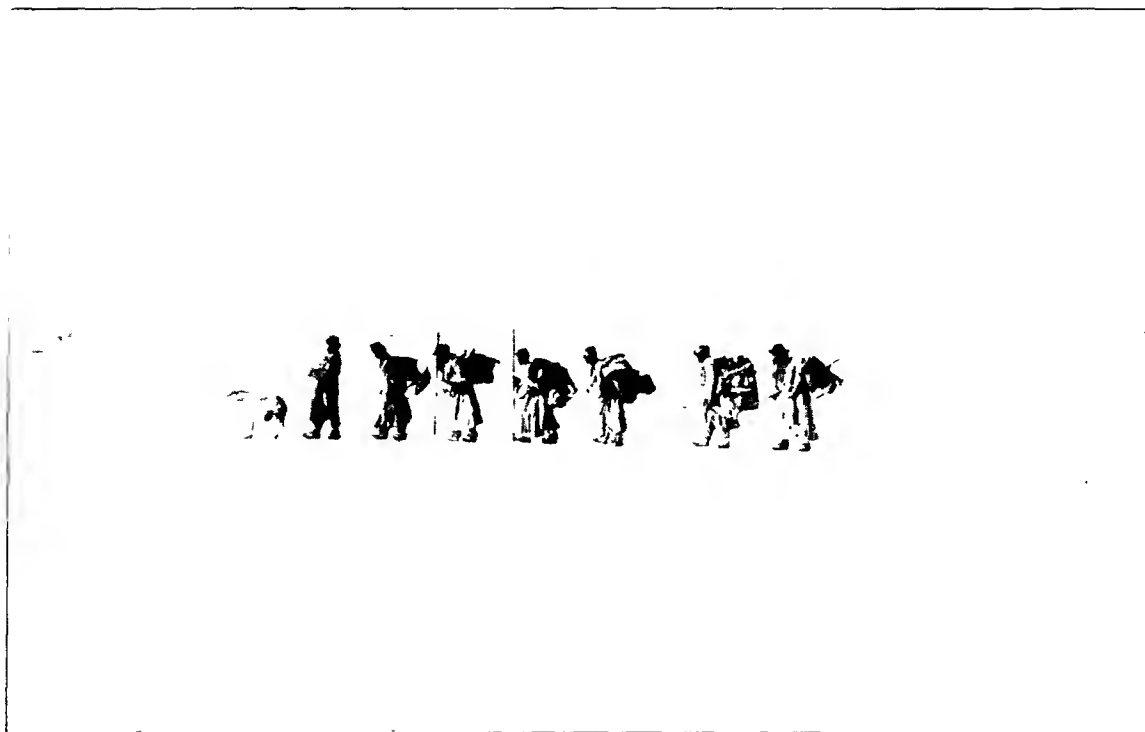
The ground is destroyed by rabbits' holes. The valley is broad, but just at its mouth, it becomes somewhat narrower. Here were springs with good running water, and the grass was better than hitherto. A round *mani* was found at the place, with well carved and inscribed stone-plates and horns of yak, some of them with the coronal bones. The camp was pitched at the right side of the valley, near some sheepfolds and not far from a Tibetan tent. A panorama, 109A and 109B, Tab. 19, was sketched. Between S. E. and south, the lake with the mountains of its opposite shore, was visible. To the S. 35° W., was the last hill at the right side of our valley and up to N. 18° E., the ridge bounding the valley to the west. N. 18° E., shows the saddle of *Laen-la*. To the N. E. and E. N. E., is Mount *Gyabsang*. On the slope of the hill west of our camp, was a grotto with a stonewall in front of it. It contained a sack of barley and some straw, and was the *samskang* or dwelling-place of a hermit or wandering lama, Lama Togldan.

One of our neighbours gave some additional information. According to him the name *Laen*, or perhaps better *Laän* or *Laäng*, the nasal sound nearly inaudible, appertained to the whole valley of *Camps XCVI* and *XCVII*. *Marku-tso*, a name that we had heard before, belonged to a small lake north of *Ngangtse-tso*, perhaps situated somewhere east of *Camp CV*. It is not the same as *Marchar-tso*. It is entered on Nain Sing's map, and is a new proof of the veracity and conscientiousness of the famous Pundit. The mountains to the S. 40° E. and S. S. E., he called *Pongchen*, which was confirmed on our march south of the lake. The mountains straight south, he called *Paklam*. In accordance with earlier information, he considered *Dangra-yum-tso* smaller than *Ngangtse-tso*, which is, as I have said, improbable, but still may be true. Its southern end was pointed out to the S. 60° W., though according to other information, it ought to be straight S. W. from *Camp XCVII*. The two small peaks on each side of the opening of the *Laen* valley, were called *Kato*, to the east, and *Yangbok* to the west. He reckoned seven days to *Govo* by the pass, *Pongchen-la*. The highway to *Shigatse* goes east of the lake. *Kemar* was said to be one day on horseback to the S. E. and thus situated east of the lake. The road on the western shore, was longer and more difficult. *Kemar* is obviously only a certain region, to which nomads come in the autumn; now it was uninhabited. West and south of the lake, were several nomads' camps hidden in the valleys, but none quite near the shore. The lake began to freeze one and a half month ago, and would remain frozen another four months. It was, however, different in different years, as the ice was sometimes said to break up in the beginning of March, which I do not believe is possible. He said that the nomads never cross the lake as they are afraid of it. He, therefore, could give no information about the thickness of the ice. Springs were to be found at many places around the shore. Our first research gave the result that the water was brackish and

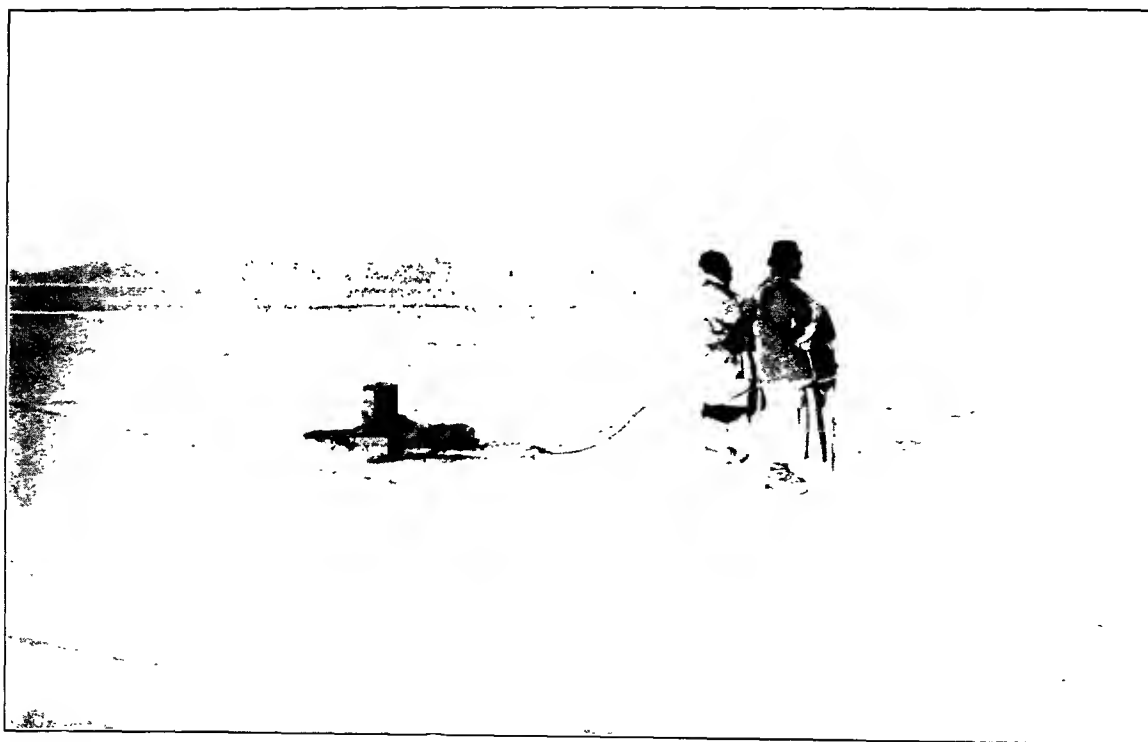


WESTERN PART OF NGANGISE-TSU





MY LADAKIS ON THE ICE OF NGANGTSE-TSO. LOOKING N. N. W. FROM CAMP 99.



MY SLEDGE ON THE ICE OF NGANGTSE-TSO. LOOKING N. N. E. FROM CAMP 99



undrinkable; in case of necessity it could perhaps be drunk in spite of its very disagreeable taste. On *December 28th*, the ice was 28 cm. thick at 100 paces from the shore, 26 cm. at 200 and 25.5 cm. at 300 paces. From these data and from the general morphology of the whole basin, the lake being everywhere surrounded by extensive flat plains, except to the south, one could understand that the *Ngangtse-tso* must be very shallow. Travelling between the *Kyaring-tso* and *Dangra-yum-tso* Nain Sing touched the northern shore of *Ngangtse-tso*, between the main lake and *Marku-tso*.

On *December 29th*, I moved down to the shore; 7.8 km. S. S. E. The ground falls 71 m. or to 4,699 m., at a rate of 1:110. From the springs of *Camp XCVII*, an ice ribbon stretches nearly 3 km. down, in the bed of the watercourse from the *Laen* valley. The bed continues winding down to the swampy ground on the shore. From the openings of several other neighbouring valleys, ice beds come out. Our valley opens out on a broad, slightly undulating plain. As the lake now lies before us, it looks rather big. Its eastern end is hardly visible at a distance of 22 km., whereas the western end cannot be seen, being 32 km. away; only the mountains beyond can be seen. To the south the extensive white surface of the lake is bounded by mountains of no great height, as will be seen on Pan. 115A and 115B, Tab. 21, from *Camp XCVIII*. On the same sketch we find the country very open to the S. 65° E., which is explained by the existence of Lake *Marchar-tso* and the open country to the E. S. E. of it. Far away to the S. W. a high mountain mass is visible in the prolongation of the western part of the lake, probably the *Targogangri*. From here it seems rocky, wild and covered with very extensive snow-fields. North of it is the mysterious *Dangra-yum-tso* hidden by the mountains to the west. To the N. N. W., the panorama shows the opening of the *Laen* valley and some other valleys coming from the mountains north of the lake.

The soil on the way to *Camp XCVIII* consists of sand and fine gravel, and there was better grass than we had seen for a long time. As this plain is exposed very much to the continual wind, the nomads prefer the more protected valleys during the winter. Having passed two old beach-lines some 4 m. high and more like walls sloping to both north and south, we reached a belt of swamps, with tussock-grass and ice-sheets between. Heaps of dung of tame yaks lay scattered about, and there were several fireplaces since the visits of nomads last summer. The grazing grounds must be very favourable during the hot season, directly exposed as they are to the sun. Then follows a lagoon covered with ice and six old beach-lines, three and three with an interval between; they are rounded and about 1 m. high. So far as their direction is discernable, they are directed to the S. 70° E. and N. 80° W. Finally we pass several small lagoons on clay ground. At the lee side of the ninth beach wall about 3 m. high, we camped (*Camp XCVIII*) 5 m. above the lake which is at 4,694 m.



In Vol. III of this work, beginning on p. 343, I have given a general description of the *Ngangtse-tso*, and there remains here only to say a few words of the crossings on the ice and the measurements of the depths, as well as to analyse the panoramas. The first line, from *Camp XCVIII* to *Camp XCIX*, on the southern shore, is 14.3 km. in length on the ice and directed to the S.  $9^{\circ}$  E., the compass bearing being taken towards a little black mountain on the shore. As a rule the ice is very regular, only traversed here and there by cracks and crevasses and covered nearly everywhere with a sheet of salt formed at the moment of freezing, and sometimes arranged in curious figures by the wind; it was generally about 2 cm. deep, at the most, 4 cm. At 8 points, at the same distance from one another, the depth was measured as well as the thickness of the ice. In meters of water and centimeters of ice, the values obtained at the different points were: 1: 4.00 m. and 21.5 cm., 2: 5.70 m. and 24.0 cm., 3: 7.48 m. and 19.0 cm., 4: 6.90 m. and 18.0 cm., 5: 9.39 m. and 18.3 cm., 6: 9.66 m. and 23.5 cm., 7: 9.80 m. and 20.1 cm., 8: 3.41 m. and 23.5 cm. The lake, therefore, proved to be extremely shallow, and as this first sounding line crossed it where it was broadest, we would not be likely to find any deeper places to the east or west.

*Camp XCIX* or *Kuring-taknak* is only a few meters above the lake at a short distance from the shore. Here Pan. 113A and 113B, Tab. 20, was sketched, giving an impression of the appearance of the mountain silhouette along the northern shore. On account of the greater distance, a few new peaks become visible. The entrance to the *Laen* valley is N.  $9^{\circ}$  W. To the east and west the country is very open.

On *December 31st*, we crossed the lake on our second line 12.5 km. to the W. N. W. To our left, one blunt promontory and cape after another comes into view, indicating ramifications from the mountain group on the southern shore. Some four tents were seen in valleys east and west of *Camp XCIX*. The ice was more regular than on the first line, sometimes like a mirror and of a bluish green, beautiful colour; only along the southern shore it had been broken up like small »torosses«. About halfway, we met a crevasse, 1.5 m. broad and quite open; at a narrower place it could be crossed. Once every 20 minutes the depth and thickness of ice were measured, giving the following result:

1: 5.17 m. and 23.5 cm.	5: 9.68 m. and 20.0 cm.
2: 7.09 » » 23.8 »	6: 8.57 » » 19.0 »
3: 8.43 » » 21.0 »	7: 5.40 » » 17.0 »
4: 9.39 » » 21.5 »	

At *Camp C* a belt of 100 m. of the shore was salt barren clay; but inside of it was a steppe of good grass where 19 ponies and a large flock of sheep were watched by a shepherd.

Pan. 116A and 116B, Tab. 21, is taken from *Camp C*. It shows two open gaps to the N.  $71^{\circ}$  E. and S.  $82^{\circ}$  E. situated at the two sides of an isolated mountain group. Through the northern one, Nain Sing has travelled. The southern one, where no kind of mountains are seen, goes in a straight line across *Marchar-tso*. To the S.  $61^{\circ}$  E., is a flat pyramidal peak south of *Camp XCIX* (*Cp.* photo). Between S. W. and S. S. W. is the end of the western part of the lake. To the N.  $70^{\circ}$  and  $72^{\circ}$  W. are two peaks called *Tsagi*. To the N. W. and north are considerable mountains belonging to the groups *Takta-tomsing* or *Kangdigar*, *Logun-napta* or *Kelam*, and perhaps partly to the range of *Lamlung-la* and *Gurtse-la*. The very distant mountain visible to the S.  $53^{\circ}$  W., is certainly the northern-most part of *Targo-gangri*.

It is interesting to examine Nain Sing's map. His topography of the lake and its surroundings is not at all bad, though of course it has to be corrected in several details. The northern mountains, he places some 15 miles back from the lake, which is thrice too much, and only proves how difficult it is to estimate distances.

The third line across the lake, accomplished on *January 1st*, 1907, took us 11.7 km. S.  $19^{\circ}$  E. in the direction of a black slope between two valleys, containing ice. The slope seemed to fall directly down to the lake, but we found that it was separated from it by a plain nearly 2 km. broad. The ice was good and favourable. Some crevasses of different breadth were crossed. They usually were stretching N. W.—S. E. In the same direction lay the stripes of salt, like a fine white powder, on the surface of the ice. Sometimes the latter is granulated or in the form of waves with the lee side to the N.  $60^{\circ}$  E., all depending on the prevailing S. W. and W. S. W. wind. To our left we had the mountain group, which fills out the broad and blunt peninsula which gives the southern shore its convex form to the north. The temperature of the night had been down to  $-26.2^{\circ}$ . The depths and the thickness of ice measured were:

1: 5.74 m. and 17.0 cm.	4: 5.63 m. and 25.0 cm.
2: 9.40 » » 18.5 »	5: 4.19 » » 27.0 »
3: 7.84 » » 21.5 »	6: 2.22 » » 44.0 »

As above, we always find a certain relation between the depth and the thickness of the ice, the latter being thicker where the lake is shallow. The shore at *Camp CI* is nearly horizontal and only a few inches above the lake. A disagreeable smell from rotten algae is noticed along the shore. There was also animal life in the lake, namely, the small crustacean I had found in other Tibetan lakes, and which has been described by Professor W. Leche in Vol. VI, Part. 1 of my *Scientific Results of 1899—1902*. On the plains, kyangs were seen in several herds. Farther south herds of antelopes were seen and on the steppe, two foxes. On the hills east of our camp, tame yaks were grazing, and in the evening, a Tibetan came to drive them down in a valley where a tent obviously was hidden.

In the afternoon the wind increased to a storm, coming from S. 85° W. It was interesting to witness the impenetrable clouds of dust and sand which now again were driven along the ground. The whole landscape around at once was concealed, even the nearest hills to the east disappeared completely. It was like a desert storm in *Takla-makan*. The solid material was swept along the ice across the lake. Where the ice is uneven, forming small waves, some coarser material remains on the lee side and will cause some melting the next time the sun returns. At seasons when there is no ice, the storms must contribute very considerably to fill up the basin of the lake. We have already found how very shallow it is, and seeing these heaps of material, one is rather astonished that the whole basin is not quite filled up. As a rule, the situation of the isobaths, however, is explained by the transporting activity of the prevailing W. S. W. wind, for the deepest part of the lake is situated in its eastern half; the western being more directly exposed to the filling action of the wind. Remembering that this destructive transporting and filling activity goes on every year for thousands and hundreds of thousands of years, one is able to realize the result we find in the level forms and flat gradients of the Tibetan highlands.

Nain Sing exaggerates the S. W. basin of the lake and makes it too broad. But as a matter of fact it is surprising that he has given the whole lake a form that is not very far from reality. This tells a good deal in favour of his capacity of observation. By passing only along one side of a lake, it is very difficult to draw even an approximately correct contour of its shore. This may easily be seen from Pan. 117A and 117B, Tab. 21, where we seem to be surrounded by a ring of mountains, all of about the same altitude, only those to the N. E. and E. N. E., just behind our camp, seem to be higher on account of the short distance. The mountains south of us were called *Tagrak-tangu*.

Our fourth sounding line goes W. S. W. across the lake and is 11 km. in length. A long distance out from *Camp CI*, the lake is so shallow that the ice is resting directly upon the black mud and ooze of the bottom, as may easily be seen in the openings of cracks. The cracks and crevasses, as a rule, run north and south, the long stripes of white salt, in the direction of the wind. Much of this salt is as if fixed to the ice, but still more is driven by the wind to the E. N. E., and out over the eastern plain. This action tends to decrease the salinity of the lake, as a certain amount of salt is carried away from the water in this way, every year. But on the other hand, the rainwater of the whole region finally flows into the lake, and takes a good deal of the windblown salt back to it. At any rate the salinity increases from year to year, though it is not yet strong enough to make animal and vegetable life impossible. The salinity also increases as the lake dwindles, as is readily visible from the beach-lines.

Only three soundings were made; 1: 2.58 m. and 25.0 cm. of ice, 2: 2.90 m. and 30.5 cm., 3: 3.23 m. and 31.0 cm. At the fourth point, there was no water at all below the ice. This seems to be against the rule pointed out above. The greatest depth on this line is found nearer the western than the eastern shore, and the ice is thickest over the greatest depth. This may depend on the secretion of the salt, and the configuration of the western mountains and their influence on the winds.

On the southern shore plain, six tents were in sight, also large flocks of yaks and sheep. From the camp the southern part of the lake seemed to have the form shown on the map. The general course of the shore could be approximately checked by two of my men wandering along the shore-line and being observed through the field-glass from my tent. Here two rivers enter the lake, the *Ayu-tsangpo* and the *Tagrak-tsangpo*. The view from *Camp CII* or *Lopo-chamga* is represented on Pan. 114A and 114B, Tab. 20. From south *viâ* west to N. 34° W., the view is hidden by the little detached mountain group just west of the camp. On the shore here and elsewhere, feathers, probably of wild geese, were very abundant. Shells of mollusks were seen at some places. At *Camp CII*, six terraces were readily visible, the highest about 6 m. high.

After a temperature of  $-23.4^{\circ}$  in the night, we continued on *January 3rd*, to the N. 51° E., making 18 km. This line was very near the fourth one, and not far to our right we had the shore. On this line, the fifth, we had several cracks and crevasses to cross. The farther east we went, the more abundant was the secreted salt on the surface, and it seemed to get nearly fixed where the ice was granulated and uneven. At certain belts, the ice formed regular waves as if the water had frozen during a light wind. On the hills of *Camp CIII*, there was a shepherd herding sheep. The mountains just S. E. of the camp, were called *Lung-ring* and a dark comparatively isolated hill to the S. S. W., *Dsumdi*. The place itself was called *Ngangpa-taktuk*. The following measurements were made on this line, 1: 3.51 m. and 26 cm. of ice, 2: 3.48 m. and 27 cm., 3: 3.59 m. and 26.5 cm., being nearly the same depth and the same thickness of ice the whole way. The temperature of the water was  $-0.75^{\circ}$ .

On *January 4th*, we moved only 6.5 km. east in search of nomads. We questioned two different informants, who checked each other, so the names given are no doubt reliable. The information collected here is to be found in Vol. III, p. 345. We have only to place some of these names on the panorama 120A and 120B, Tab. 22, taken from *Camp CIII*. Beginning from S. 14° W. we have Mount *Dsumdi* and to the S. 59° W. *Lopo-chamga*, which was pronounced *Lopo-samcha* by another informant, and the small detached hill near the S. W. shore that has the form of a Tibetan tent. Farther to the right, there follow other mountains separating the basins of *Ngangtse-tso* and *Dangra-yum-tso* from one another. To the N. 65° W.,

is the double peak, *Tsagi*, with its very steep slopes to the S. W. and called *Tsogi* by another informant. The same mountain will easily be recognized on Pan. 113 from *Camp XCIX* where it is visible to the N.  $68^{\circ}$  W., and on Pan. 116B, from *Camp C* where it is seen to the N.  $46^{\circ}$  W. A pyramidal peak to the right or east of it will also easily be recognized on the different panoramas. These and many other mountains on the panoramas just mentioned may readily be fixed on the map. To the right of the last-mentioned peak, or N.  $42^{\circ}$  W. on Pan. 120A, we have the *Takta-tomsing*, also called *Kangdigar*, or *Gangdigar*, a pyramidal snow-peak, near the southern base of which, is the shore of *Dangra-yum-tso*. It seems to belong to the same range which we crossed in *Laen-la*. To the N.  $30^{\circ}$  W. is the peak and mountain group, *Logung-napta*, belonging to the same range. *Gursing-nagya*, N.  $6^{\circ}$  W. is, as mentioned above, situated on the western side of the *Laen* valley. To the N.  $28^{\circ}$  E., is the snow-covered pyramidal peak of *Potug*. To the right of it, or S.  $33^{\circ}$  E. is *Pu-ngumpo*, and still farther east, or N.  $61^{\circ}$  E., *Langchen-kabarak*, or perhaps properly *Langchen* and *Kabarak*, signifying two peaks.

To the south of the S. W. part of the lake, there is as a gateway between the mountains called *Dungse*, by which a road is said to go to the district of *Sangke* 3 or 4 days distant. The name *Dungse*, reminds us of Nain Sing's *Dungche-cho* as another name for *Ngangtse-tso*, for he usually writes *ch* instead of *ts*. *Marchar-tso* is well-known everywhere; *Gari-tso*, also mentioned as being situated east of *Ngangtse-tso*, is impossible to identify, though it may exist east of *Marchar-tso*. *Tagerak-tangu*, mentioned as being located south of *Camp CI*, is probably the name of the whole plain at the sides of *Tagrak-tsangpo*, and should, therefore, better be spelled *Tagrak-tangu*. *Tagrak-rung* is probably simply the valley of *Tagrak-tsangpo*. In connection with *Logung-napta* and *Lamdang*, which by other informants were pronounced *Logung-nakta* and *Landang*, some other names were given, though only a few of them can be located: *Lopo-tuti*, *Na-chugo* perhaps identical with Nain Sing's *Chuku*, *Tsong*, *Na-nagor*, *Tunglung*, *Kala* situated south of the lake, *Tungtse*, *Mukbo-chungra*, *Savo-tunpo*, *Gyangtse*, *Damchen*, *Karep*, *Nyeta-kusho*, *Salung*, *Pong-chen*, the pass mentioned above, *Kai-ketsung*. To the S. E. *Togi*, *Tsilak*, *Kung-rapka* and *Shichak* were situated. *Chimdan-la* was a pass south of *Marchar-tso*. Here, for the first time, I heard of the mountain, *Pabla*, which was said to be situated south of the first ranges to the south of *Ngangtse-tso*, information which later on proved to be correct. Many of the names I heard, agree perfectly with those given by Nain Sing. On the other hand, he has some names which I could not identify and which the Tibetans pretended not to have heard. This does not, however, prove that they are incorrect.

The nomads we met on the southern shore, asserted that the lake freezes in the beginning of November and remains frozen to the beginning of April, which

fairly well agrees with what we had heard before. The spring storms were said to destroy the ice. Wind-driven dust and sand accelerates the melting, and the whole ice-sheet becomes like a plain of mud, as could be seen every year. In contradiction to other informants, we were now told that the nomads sometimes make use of the ice for short-cuts across the lake.

On *January 5th*, we made the sixth crossing of the lake, being 9.8 km. to the N.  $19^{\circ}$  E. The ice was partly even and clear, partly granulated, undulated and covered with salt. There was much more of the latter accumulated here than in the west which, of course, is a result of the action of the wind. As a rule the ice was a little convex below the salt accumulations, which, therefore, seem to protect it. Cracks and crevasses appeared here and there, though less numerous than in the west. The following soundings and measurements of the thickness of the ice were made, 1: 6.91 m. and 19 cm., 2: 9.53 m. and 20.5 cm., 3: 10.03 m. and 23 cm., 4: 9.70 m. and 23.5 cm., 5: 8.93 m. and 21 cm., 6: 7.47 m. and 20 cm., 7: 0.74 m. and 51 cm. The greatest depth in the whole lake was thus 10.03 m., though it must indeed be said to be extremely shallow. At *Camp CV* the old beach-lines were well developed.

From the same camp, Pan. 118A and 118B, Tab. 21, was sketched. It shows to the east and E. S. E. a silhouette of the isolated mountain group situated north of *Marchar-tso*, and to the S. E. and south, parts of the considerable range which I have given the appellation, *Ngangtse-tso* Range. To the S. S. W. is the bulky mountain group which makes the southern shore convex towards the north. To the S. W. is the largest extension of the lake and S.  $50^{\circ}$  W., is the little detached group of *Lopo-changa* and *Camp CII*, resembling a Tibetan tent. To the S.  $65^{\circ}$  W., the country is comparatively low in the foreground, but at a great distance, a high snow-covered range is visible which may be the northern-most part of the *Targogangri* Range, for as a matter of fact we really do not know how far this range extends northward. To the west we again recognize the double peak of *Tsagi*, sketched on three of the previous panoramas. Then follows, to the right or east, the mountain range we had crossed in *Laen-la*, and several of whose peaks may be identified by comparison with Pan. 120.

On *January 6th*, after a temperature of  $-22.6^{\circ}$ , about the same as the night before, we made the seventh and last crossing, 14 km. towards S. E., to the S. E. end of the lake. The ice had about the same quality as the day before. The following soundings and measurements of the ice were made: 1: 5.68 m. and 21.5 cm., 2: 7.32 m. and 24.5 cm., 3: 8.35 m. and 26 cm., 4: 8.33 m. and 29 cm., 5: 7.16 m. and 27.5 cm., 6: 5.07 m. and 30.5 cm., 7: 4.01 m. and 36 cm.

Herewith our soundings were ended. They had been taken at 41 points, and we had covered about 60 miles on the ice. From the endpoint, we had 7 km.

northwards along the eastern shore to *Camp CVI*, the march being made partly on the ice, partly on the lowest beach wall. The latter is very regular and more energetically modelled than in the west; it is 5 or 6 m. broad. Above it there are nine other beach-lines reminding one of the seats in an amphitheatre, the highest being some 12 or 15 m. above the lake. Inside of the lowest wall, there are oblong depressions with a perfectly level floor of clay brought down after rains; now they were dry. The soil around the beach-lines consists of fine gravel and is absolutely barren. There are many shells of mollusks. By the shore formations, it is clearly visible that this side of the lake is much more exposed to the action of the waves than the western or any other shore; the same observation I had been able to make in 1901, for instance at *Chargut-tso* as described before.<sup>1</sup> On the plain east of *Ngangtse-tso*, kyangs were numerous.

On *January 7th*, after a night of  $-22.2^{\circ}$ , we marched 13.7 km. N. W., at a short distance from the shore, to *Camp CVII*, where the height is 4,767 m. This camp is, therefore, 73 m. above the lake. In a straight line, it lies only 1.7 km. from the shore, the rate of slope on this line is, therefore, as 1:23.3. Following the shore we were again exposed to a strong W. S. W. wind, making the atmosphere hazy above the ice, and the western mountains unclear. Herds of the little *Gazella picticaudata* were grazing, and kyangs were again observed. A caravan of a few men with about 50 yaks wandered in the same direction as we; they were people from the *Laen* district who had been south to buy *tsamba* and barley, paying with salt. The grass of the steppe was unusually good, about one and a half feet high. The ground becomes a little undulated, and we have to cross several beds and ravines, two or three meters deep and from 10 to 100 m. broad, the larger being the erosion furrows from the mountains, the smaller, eroded by brooks from springs. In a few of the latter, there was still some ice. Among low rounded hills and at the bank of a deep erosion bed with running water from springs, *Camp CVII* was pitched.

At this camp I was stopped and after nine days again allowed to continue, by my old friend Hlaje Tsering, the governor of *Naktsang* Province. West of *Ngangtse-tso* he reckoned four days to the frontier between *Naktsang* and *Labrang* or *Tsang*; east of the lake it was only two days to the frontier. To the west he reckoned ten short days' marches to his frontier if passing by *Ombo*, *Letö* and *Potö*, the last-mentioned being the western-most place of his province. He would under no conditions allow me to visit the *Dangra-yum-tso*, which was a sacred lake. My lake *Naktsong-tso* or rather *Naktsang-tso* of 1901, he and his men now called *Puchin-tso* or *Arta-tso*, as »every lake in his province could be called *Naktsang-tso*«. The real name of this lake, therefore, still remains to be determined.

<sup>1</sup> *Cp. Scientific Results etc.*, Vol. IV, p. 87—88 and 169—171.



THREE TIBETANS FROM NAKPANG, AT THE NORTH-EASTERN SHORE OF NGANGTSE-PO







HAJE TSERING, THE GOVERNOR OF NAKISANG, WITH HIS MEN AT CAMP 107.



THE WESTERN SHORE OF NGANGTSE-TSO AT CAMP 100.



Somewhere near *Camp XCVIII* and *Camp CVII*, we crossed the route of Nain Sing on his memorable journey of 1874. On *January 17th*, we travelled S. E., passing *Camp CV* and *Camp CVI* and finally following the eastern shore of the lake, southward to *Camp CVIII*, where fresh-water springs formed an extensive ice-sheet. In a little valley in our neighbourhood, called *Damsa-keva*, were two Tibetan tents. The day was very cloudy and twice or thrice some snow fell, not even enough to make the soil white.

From *Camp CVIII*, I sketched a last panorama, 122A and 122B, Tab. 22, of *Ngangtse-tso*. There we again recognize some of the features of the surrounding mountains which are already familiar to us from several other panoramas. From about N.  $41^{\circ}$  E. to east and E. S. E., we have the isolated mountain group situated north of *Marchar-tso*. To the S.  $80^{\circ}$  E., the country is open in the direction of *Marchar-tso* and its prolongation. From S.  $61^{\circ}$  E. and thence the whole way around, across south and to the west, we have the range situated south of the two lakes, the southern boundary of which may be said to be marked by *Tagrak-tsangpo* and its valley. To the N.  $83^{\circ}$  W., is the northern-most promontory of the shore between *Camps XCIX* and *CIV*. To the W. N. W., are the mountains rising between *Ngangtse-tso* and the northern half of *Dangra-yum-tso*. From about N.  $60^{\circ}$  W. and thence the whole way to the right until the end of the panorama, we have the ranges bordering the *Ngangtse-tso* on the north, and N.  $33^{\circ}$  W., we recognize the entrance to the *Laen* valley.

At *Camp CVIII* on the S. E. shore of *Ngangtse-tso*, the first great section of my journey in Tibet had come to an end. We had crossed the boundless *Changtang*, the plains and mountains of the northern plateau-land, and we had also crossed the zone of the Central lakes and the small ranges between it and the valley of the *Bogtsang-tsangpo*. In a later chapter, I will give a general résumé of the morphology of the whole country.

Only two or three observations will be shortly entered here. We had found grass nearly everywhere, and it, therefore, seems that western Tibet, regarding the vegetation, is more favourably situated than eastern Tibet, where I, in 1900 and 1901, had met with greater difficulties from want of grass, though I then travelled during the summer. Therefore, the ground is more solid on my route of 1906, for the soil is bound by the roots of the grass and other plants. On the barren stretches of the eastern routes, the ground was generally very soft and trying, often more like a quagmire which could not be crossed without danger. Mud-flows were a more general occurrence in the east than in the west, though we had had soft soil beyond the *Chang-lung-yogma*. Later on in the autumn it was, as a rule, difficult to tell whether the soil was soft or hard in summer, for in the cold season, everything is frozen. Still the barrenness of the eastern regions is

reason enough to make the soil soft as there are no roots to make it solid. Due to the same reason, the rabbits are particularly numerous in the west as they live on the roots. Curiously enough we had not seen a single marmot on the western route, whilst such animals were common farther east. Nor had we seen a single bear on the western route, only on the eastern ones, which seems to be due to the bear's liking the marmots' flesh.

The material filling the latitudinal valleys and depressions in the east, is as a rule, finer than that in the western parts of the plateau-land, which is due to the sorting action of the prevailing winds. Probably the S. W. and W. S. W. wind is, as a rule, stronger in the western parts of High Tibet than in the eastern. The fine material is, therefore, carried away from west to east, and reaching the eastern regions, it settles down and is deposited in the depressions. Valleys and plains covered with gravel are, therefore, more numerous in the west than in the east, due to the sorting power of the wind. It may also depend on the greater corrasive action of the wind, that the levelled plateau-like character with rounded flat mountains and small relative differences of altitude between crests and valleys, is more pronounced in the west than in the east. On the eastern routes I crossed higher and more difficult passes than on the route of 1906, on which we did not cross a single difficult pass. By purely morphological reasons and on account of the existence of grass, the western route is, therefore, easier. The great mortality among the caravan animals, only 10% of them reaching *Camp CVIII*, is caused chiefly by the wind.

We had not crossed a single high pass or a single mighty range that could be suspected of being the south-eastern continuation of the *Kara-korum* Mountains. In my *Scientific Results*, I had expressed the opinion that this mighty system must cross the whole of High Tibet and reappear in the *Tang-la* System in the east. But in 1905, when this theory was written down, nearly nothing was known of the central *Transhimalaya*. At the end of this work, I shall have to enter upon this most important and interesting problem.

The continuation of my journey from *Camp CVIII* the whole way to *Gartok*, including the first five crossings of the *Transhimalaya*, has been described in Vol. III p. 247 *et seq.* In Vol. II, I have described my researches in the valley of the *Tsangpo* and on and around the *Manasarovar* and *Rakas-tal*, as well as the sources of the *Brahmaputra*, the *Satlej* and the *Indus*. The only thing that remains to do is, therefore, to describe the physical geography and morphology of my route from *Gartok*, through the *Indus* valley, back to *Ladak* and up through the *Shayok* valley to *Changtang* where the second great crossing of High Tibet begins and stretches the whole way down to *Chunit-tso*, where we again come into contact with the last three crossings of the *Transhimalaya*, described in Vol. III.

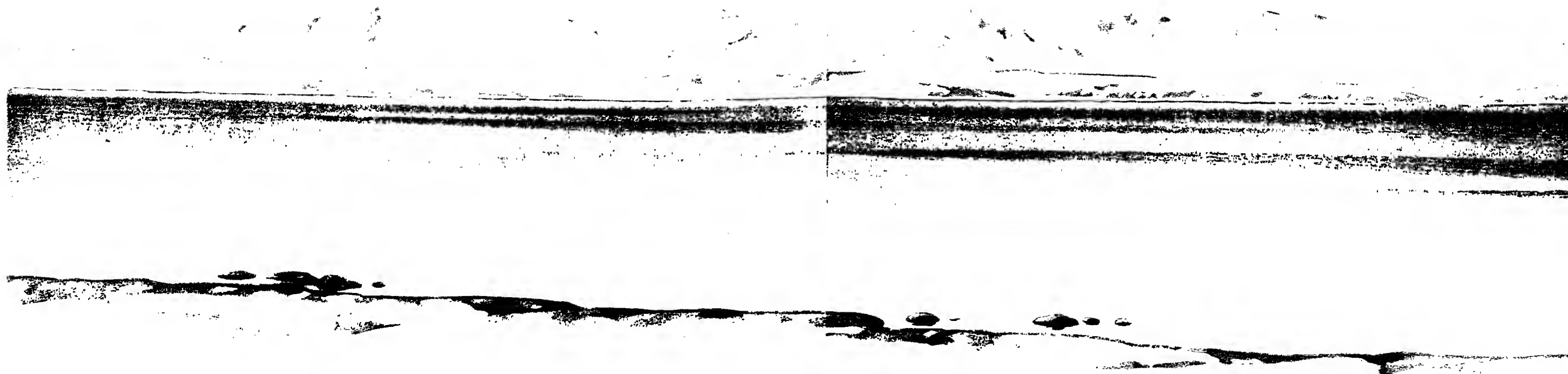
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JOURNEY FROM GARTOK  
TO TANKSE









LAKE MANASAROVAR AND MOUNT KAILAS AS SEEN FROM TUGU-GOMPA



## CHAPTER XIII.

### FROM GARTOK TO THE JUNCTION WITH THE SINGI-KAMBA.

In my personal narrative I have described *Gartok* and my long rest there in the autumn of 1907. Here it only remains to direct the reader's attention to Pan. 350A, B and C, Tab. 62, which will give a much clearer conception of the surroundings than any descriptions in words. The panorama begins with S. 25° E. This is about the direction in which *Jerko-la* is situated. The pass has, according to Ryder, an altitude of 4,938 m. *Gartok* is at 4,469 m. The distance between the two is 48 km., and the difference in height, 469 m. The ground, therefore, falls from the pass to *Gartok* at a rate of 1:102. Though some of the feeders of the *Gartang* or *Gartok* branch of the *Indus* may be some kilometers longer than the brook from *Jerko-la*, the inclination of the ground given above may be considered as a figure for comparison with the values of the fall of the *Gartang* valley from *Gartok* and farther down.

S. 9° E. from *Gartok*, there is a regular conical peak called *Taram*. From this peak and the whole way across west and to N. 41° W., the panorama gives us an aspect of the mountain range and the different ridges at the left or S. W. side of the valley of the *Gartang* River. This system is the one that has been called the *Ladak Range* by Colonel Burrard. Lower down it is pierced in a transverse valley by the joint *Indus*, just at the point where my route leaves the *Indus* valley. The system to the right or N. E. of the *Gartang*, which I had crossed in the *Jukti-la* as described above<sup>1</sup>, belongs to the *Transhimalaya*. The following names were given to me as belonging to different mountains and regions of the part of the *Ladak Range* that is visible from *Gartok*. To the S. 12° W., is *Lachäp*, and to the right of it, *Gatsong*; S. 38° W., is *Chapchak* and S. 56° W., *Tapchak*, a rather deep-cut valley in the nearest ranges. To the west, opens the valley, *Sungchung*, which seems to be the one by which Ryder returned from his memorable

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<sup>1</sup> Vol. III, p. 341.

journey, *viâ Ayi-la* to India. N.  $69^{\circ}$  W., the curious sounding name, *Hlangchen-kamba*, was given. It reminds us of the name *Langchen-kamba*, or the Mouth of the Elephant River, which is the *Satlej*. Certainly a tributary to the *Satlej* has its origin on the other side of the ridge in question, but it is some 280 kilometers shorter than the principal branch of the river. Still it is interesting to see that one of the sources of the *Satlej* is pointed out so far from the real source. *Namru* is a ridge to the N. W., and N.  $41^{\circ}$  W., is the direction one has to follow to reach the junction with the *Singi-tsangpo* or *Indus*, indicating the stretching of the valley from *Gartok*, and the whole way down to the transverse valley, through the *Ladak Range*. To the right of the opening, is *Churul-ri*, and N. N. W., *Gältsa*. Here in the foreground, we see the many tents and a few stone buildings of *Gartok*, and in the background, some considerable valleys in the *Transhimalaya*. To the N.  $23^{\circ}$  E., is a region of peaks and valleys called *Langchen-langchung*. A little to the right of N. E. we have the entrance to the valley leading to *Fukti-la*. To the N.  $75^{\circ}$  E., is a mountain called *Sak*, and to the right of it the valley, *Sakchen-sakchung*, comes out to the principal valley. To the S.  $65^{\circ}$  E. is the *Sangu-dongbo*, and finally, S.  $47^{\circ}$  E., is a distant mountain somewhere north of *Ferko-la*, and called *Par*.

From *Gartok* my road to *Tankse* runs for about 333 km. N.  $41^{\circ}$  W. in a very nearly straight line. *Gartok* was my *Camp CCL1*. Its height is 4,469 m. On *October 20th*, I left *Gartok* and travelled N. W. 15.7 km. to *Nima-lung* where the altitude is 4,422 m., being a fall of 47 m. or at a rate of 1: 334, only one third of the slope from *Ferko-la* to *Gartok*. We leave this place with its temple, tents and buildings, as well as the brook from the *Fukti* valley which soon joins the *Gartang*, to our right, and cross four branches of the latter river, two of them being very small. One was frozen all over, the others had ice only along the banks. The soil is covered with coarse sand and gravel, and some grass, of which, at this season and on account of the neighbourhood of so many caravan animals, not much is left. After proceeding a few kilometers, we cross several dry river beds, proving that the *Gartang* may be a considerable river after a rain in the latter half of the summer. The main branch itself, which we crossed, had now a very small volume of water, with a temperature of  $+8^{\circ}$  at 1 o'clock, and small ice bands only in protected shadowy bends. Its left erosion terrace is about 4 m. high and also proves that the erosion has been strong in former times.

Riding on the left side, we leave the river out of sight for a while until we again touch a bend not far from the mouth of the broad, but short, valley of *Sungchung*, also pronounced *Sungjung*. To the right, the *Gältsa* valley opens out. Between its erosion terraces, of which the left one is double, the river bed is very broad. The road follows the lower left terrace. The upper one which we have immediately to our left, consists of yellow clay deposited horizontally. Here and

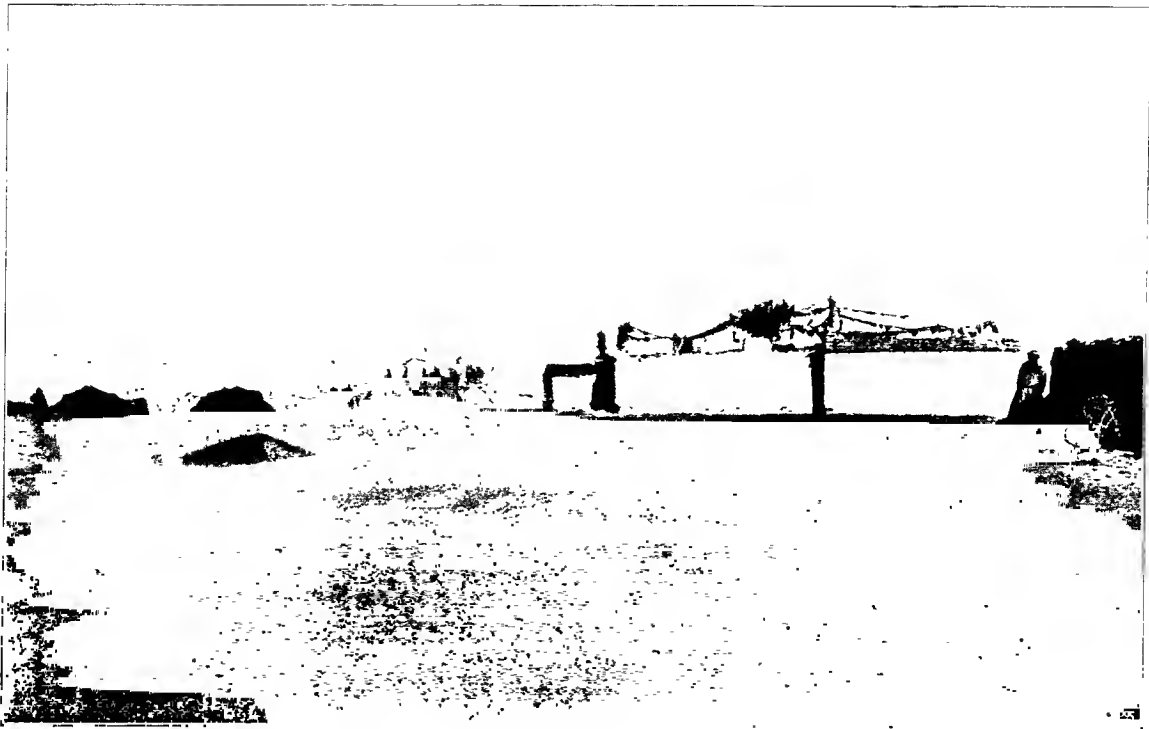


A LADAKI AND SOME TIBETAN WOMEN AT GRATOK



TIBETAN WOMEN AT GARTOK (BY MISTAKE THIS PHOTO, HAS BEEN REPRODUCED TWICE,  
CP. VOL. II, P. 161).





GARTOK-GOMPA. LOOKING N 75° E.



GARTOK. LOOKING N 3° W.





there we find some bush vegetation with small earth cones kept together by the roots and occasionally with some sand accumulated at their lee side. Hares are numerous. The winding river is immediately to our right. Sometimes the terrace is broken through by ravines, formed by watercourses from the *Ladak Range*. The valleys are short, but deep-cut, and have, as a rule, flat fans at their mouths. On the Transhimalayan side we have, after *Gältse*, a comparatively flat group with small transverse valleys.

The valley now becomes more and more narrow and at both sides the mountains are near. The different branches of the *Gartang* join in one bed. The stream is slow, the water perfectly clear and fish are abundant. The bed is gravelly. The colour of the mountains is pink and brownish. Just at the entrance of a very narrow défilé, *Camp CCLII, Nima-lung*, was pitched. The gorge is winding between terraces some 20 m. high, and here the river forms rapids among blocks and boulders. Of the Transhimalayan or right side of the valley, Pan. 354, Tab. 63. is made. It shows, to the N. 17° W., the narrow gorge between its high terraces, and a rather solid mass to the north and N. E. To the S. E., is the open valley in the direction from which we have arrived.

On *October 21st*, we continued in the same direction for 18.3 km. to *Camp CCLIII*, where the altitude is 4,372 m. or 50 m. below the previous camp, giving a fall at the rate as 1: 366.

Leaving *Nima-lung*, a place known for its numerous wolves, but still used as a camping place as could be seen from the remains of many camps, we slowly ascend small valleys and ravines, with some gravel of granite and gneiss, and lose sight of the river and its narrow passage. In the gorge, sedimentary schist cropped out, otherwise we did not pass any living rock the whole day, as the *Gartang* had worked its bed down through pebbles and shingle, sand and clay. From the left, opens a tributary called *Nima-lungpo*. A little side valley, parallel to the main valley but sloping in the opposite direction, takes us up to the flat and open threshold, *Chagring-la*, 4,534 m. high, adorned with a cairn and a pole with rags and *mani*-streamers. To the north the hills fall slowly down to the river, the gorge of which is visible at a distance. No snow-covered peaks are in sight. To the S. E., in the direction of *Jerko-la*, distant mountains still rise above the horizon. Continuing our journey, we pass a second *mani* cairn and descend a very steep ravine between nearly perpendicular side-walls of pebbles and shingle and leading out to the tributary valley, *Chagring-rong*, which after a while joins the *Gartang* valley in a little plain covered with grass.

From here the road follows the river, which is immediately to our right. It very often forms small rapids. The road is very good, and the quantity of gravel insignificant. It is very comfortable for riding. One sees that it is an important

road used by many travellers, and especially by all the caravans to and from *Ladak*. From the point where the river again comes out to its narrow passage, which is about 8 km. long, the valley of the *Gartang* slowly opens out and becomes broader. The erosion terraces are always well worked out. Old terraces are often seen at some distance from the river, rounded by wind and weather and pierced by tributaries. A larger valley from the left in which a road is said to proceed to a pass called *Laling-gurtsak*, is called *Chumbo*. Near its mouth is a little lake or pool, called *Chumbo-tso*, where the height is 4,382 m.; it seems to be formed by springs and it has an affluent in two branches. This part of the extensive valley has the name *Samda-kong*. The mountains on the left side are now steeper than those on the right. Two *manis* of stone are passed. A grass steppe with some bushes is called *Namru*, and *Shinkar* is a large tributary valley from the left with a mighty dark mass, partly snow-covered, in the background. It is a part of the *Ladak Range* and has the province of *Chumurti*, on its S. W. side. At the left side of the *Shinkar* bed, there is a double terrace, at least 50 m. high. The floor of the main valley is not plane but slightly undulated, the material consisting of pebbles and shingle, deposited at an early period between the ranges to the right and left.

Here the hot springs, simply called *Chusan*, are passed. The first one comes directly up from the even ground on the left bank of the river and 2 or 3 m. above its surface. The ground is white and slightly convex. The next is a basin from the bottom of which several hot springs are bubbling up, the temperature of the water being 60.5°. Another small spring contains boiling water. The bubbling of the water here resembled a geyser, for the water gushed up about once a minute and during the intervals remained more quiet. A similar boiling spring was protected by a stone wall. From the different springs small canals had been cut in the ground conducting the water to a basin surrounded with a stone wall and used as a bath, which is supposed to heal sickness. Another ring-wall serves as a dressing room. Two or three *manis* with poles and rags indicate a certain religious importance of the place.

A short distance beyond the hot springs, the second branch from *Chumbo-tso* joins the *Gartang* and gives it a comparatively large tribute. The *Gartang* River had carried some ice during the early hours, but at noon the latter had again disappeared. Finally the road again goes up on the top of the steep terrace where the hard ground partly consists of gravel and is barren. At *Luma-ngoma*, we have our *Camp CCLIII* on the narrow steppe along the left side of the river. A little panorama, 353, Tab. 63, shows the appearance of the valley to the N. W. and north, the considerable terraces and the decreasing height of this part of the *Trans-himalaya*, its accentuated sculpture, and the wide fans at the mouths of its transverse valleys.

So far, we had not seen a single tent. At *Namru*, where barley is grown, there is nobody dwelling at this season of the year. The autumn had set in with a temperature of  $-24.8^{\circ}$  on the night of the 20th, which, however, was exceptional. On October 22nd, a rather severe S. E. wind was blowing from early in the morning until 11 o'clock a. m. after which the wind became S. W.

On *October 22nd*, we continued N. W. for 26 km. to *Camp CCLIV* at a height of 4,287 m. or 85 m. below the previous camp. The rate of fall is as 1:306, not quite as slow as the day before. During the first section of the day's journey the road passes among fluvial terraces, after which the ground is perfectly even and consists of coarse sand. On the right bank, there is a stripe of bushes. The mountains to the left side are higher and wilder, of a dark brownish colour and with snow on a few peaks which we had already seen from *Gartok*; those to the right are lower and of pink and reddish tints. In the mouth of a valley to the left, barley is cultivated. A meadow by the river was called *Lenche*. *Kalung*, *Marale* and *Tarchung* are valleys from the mountains to the left; *Ragaltse* a peak on the same side. On the right side, two names were given later on, *Nema-ngombok* and *Kardla*, being tributary valleys. Near *Gar-gunsa* another valley has a road to a pass called *Boptsang-la*, by which it is only a one day's journey to the valley of *Lang-chu*. From *Chorten-Merbo*, the terraces retire more and more from the river, and the perfectly even floor of the valley is covered with abundant bush vegetation forming a regular steppe. Two tents are passed. We cross some small brooks from the left side valleys, and patches of swampy ground. The ground consists of clay and is overgrown with grass, where large numbers of yaks, flocks of sheep and some ponies are grazing. To our right is the ruin of a house said to be the older *Gar-gunsa*, which once was destroyed by the inundation of a tributary and, therefore, removed to its present place. The present *Gar-gunsa*, to which the Garpuns or governors and the lamas of *Gartok-gompa* move in winter, consists of a few small houses on the left bank of the *Gartang* River. Though the difference of altitude is only 182 m., the climate of *Gar-gunsa* is said to be much milder than that of *Gartok*.

For the mountains and valleys visible from *Gar-gunsa*, the following names were given, all entered on Pan. 357A, B and C, Tab. 63. *Shinkar-laoche* is a pyramidal peak, S.  $25^{\circ}$  E.; the *Shinkar* valley seems to come from it; S. S. E. is *Chong-kala*, and to the south is the region *Ganchung-karu*. These and the following names are to the left, or belonging to the *Ladak Range*. About S.  $33^{\circ}$  W., is the *Tarchung* valley which seems to be more considerable than other transverse valleys of the range. *Kula-tesum* is a sharp peak S.  $49^{\circ}$  W., and to the W. S. W. are the mountains of *Harung-kungma* and *Abi-chungtse*. To the right of them, the mighty and solid shoulders of the *Ladak Range* are seen in a foreshortened

perspective, falling steeply down to the even floor of the *Gartang* valley. The last visible peak on the left side, is called *Gavorap-dun*. To the right of it, or north-westwards, the continuation of the valley forms an opening between the two mountain sides. The Transhimalaya side has more moderate heights and no snow peaks. *Kuru-mungmu* is the first name met with. Then follows *Tele-rakpa*, which is a pass leading to *Lang-chu*. *Kongmo-toa* is a peak to the N.  $8^{\circ}$  E., and *Loblung* a valley east of it. *Dorche-yuton* is a peak and probably a valley to the N.  $36^{\circ}$  E., and *Kamsang* a peak, N.  $87^{\circ}$  E. with the valley *Lung-maru* at its base. The *Kamsang* valley, no doubt, comes from the peak of the same name.

After a rest at *Gar-gunsa*, I continued to the N. W. On *November 9th*, we made 13.7 km., descending only 21 m. or from 4,287 m. to 4,266 m., being at the rate of 1:652, which is indeed a very insignificant fall. Crossing the branch of the river at which *Gar-gunsa* is situated, we leave it out of sight, but have another branch to our right. Both were covered with ice, except a few places with stronger currents. To the right is a tent surrounded with grazing flocks, to the left, a little barley field. Two or three small caravans brought fuel to *Gar-gunsa*. The ground of the valley is as level as the floor of a room, and the fall to the N. W. is, of course, insensible and imperceptible to the eye. The material is yellowish grey dust, sometimes barren or crossed by dry beds, but as a rule, overgrown with grass and bushes. The left branch is again crossed at a point quite near to the base of the *Ladak Range*, where an extensive grey fan is lying in the mouth of a steep transverse valley. In the neighbourhood, are two *manis* built of hard stones. Below the fan the soil consists of coarse sand, but there is no gravel the whole way. Here the soil is barren and we see to our right, the yellow stripe of grass with brown patches of bushes, and the belt of vegetation along the different branches of the river. Kyangs are seen and hares are numerous. The landscape is very monotonous, as usual in extensive tectonic valleys. As hitherto the *Ladak Range* is dark, steep and mighty, the *Transhimalaya Range* more flat, lower and of reddish tints. The weather was very good, cold but still, the strong autumn storms not yet having begun.

From *Camp CCLV*, at *Chiu*, where we stayed near a spring, two small sketches were made, Pan. 355 and 356, Tab. 63, the first showing the opening of our large valley to the N. W., the latter the mountains S. S. E. belonging to the *Ladak Range*.

On *November 10th*, we made 24 km. N. W. There is nearly no fall at all if the boiling point thermometer and the three aneroids can be trusted, but of course the constant changes of the atmospheric pressure make these observations reliable only within certain boundaries. However, at *Chiu* we were at 4,266 m., and at the next camp, *Langmar*, at 4,258 m. or 8 m. lower, the fall of the valley thus being only as 1:3000.

In the night the temperature was at  $-23.2^{\circ}$ . The weather remained beautiful and there was no wind at all. From *Chiu* a few names were pointed out. To the N.  $70^{\circ}$  E., was a more considerable transverse valley, *Tele-rakpa*, visible on the panorama from *Gar-gunsa*, and leading to the pass of the same name which is said to be N.  $35^{\circ}$  E. from *Chiu*. *Pele-rakpa* may be the correct form. The mountains around it are yellowish. Directly beyond it is *Lang-chu*. To the S.  $73^{\circ}$  W. is a small transverse valley in the *Ladak Range*, called *Loung* by some, *Lungun* by others. Due south of *Chiu* is the valley *Arko*, and to the west the valley *Seata*. Of course there are innumerable valleys, and probably most of them have their appellations.

Our road again leaves the belt of vegetation and the river, and approaches the left base of mountains where the ground consists of gravel, coarse sand and small boulders and blocks, mostly granite. Here again a little *mani* is built. The brook, *Loung-chu*, from springs was completely frozen. The road then turns to the north, avoiding a very extensive scree, after which the soil consists of sand and fine material, with some gravel here and there. Between the fans from both sides the level ground of the valley is very broad and open. The river sticks to the right side. *Tama-kera* is a valley to the left, *Belung* and *Lungpe-ringbo* are the next. *Tigul-la* or *Tiju-la* is a larger valley to the left with a road over the pass, *Tigul-la*, by which *Chumurti*, or *Chumoding*, as they said, is reached in three or four days. This pass seems to be of considerable height. *Gamun-gele* just west of this valley is a more dominating mountain. To the right is *Chumik*, a little valley with a spring. Farther N. W. on the same side, is the valley *Pelung*, and the mountain *Dung-ri*. We cross a surface which during the summer is under water. Here the soil is grey clay and sometimes sand. The river, *Gartang*, is again visible to our right. It seems broad and large, which obviously is due to the inundations caused by the freezing. The road goes on the top of the terraces, from which one has a good view of the bed. Sometimes we nearly touch the edge of the fans, from the small valleys and gorges to our left. The fans of the left side are much larger than those of the right. This is due to the fact that the *Ladak Range* is mightier and higher, so that greater amounts of detritus and débris are brought down by its watercourses, and also to the fact that this range is more exposed to the precipitation than the *Transhimalaya*. A very considerable part of the floor of the valley is, therefore, occupied by the fans on the left side. This is also the reason why the river here has a tendency to approach the right side of the valley. From the top of one of these fans, one has a brilliant view to the N. W. One sees in light blue tints, the distant mountains far beyond *Dem-chok* and the political frontier of *Tibet*. At no great distance, the mouth of the valley is seen, by which the *Singi-kamba* or *Indus* comes out after having broken

through the *Transhimalaya*, and beyond it the monastery *Tashi-gang* rises on its little cliff.

The brook from the *Tigul* valley is divided into three branches, now frozen. Here four *manis* are erected. The principal valley becomes broader, and is more like a plain in front of us. We stopped at the little village of *Langmar*, consisting of half a dozen black tents, most of them surrounded by fences of twigs and brush-wood, and all having streamers on poles. A short panorama, 358, Tab. 64, showing the mountains to the north, was sketched from this camp, No. CCLVI.

On *November 11th*, we travelled 9.5 km. N. W. to the junction of the *Gartang-chu* with the *Singi-kamba* or *Indus*. The fall of the ground is nearly as slow as the day before, or from 4,258 m. to 4,254 m., only 4 m., or as 1:2375.

The minimum temperature was  $-24.8^{\circ}$  and the next day was very fine and without wind. We approached the base of the mountains to the left by a roundabout way, thus avoiding a labyrinth of terraces, ravines, tussock-grass, bushes and ice-sheets. Near the hills was a tent surrounded by a wall, inside of which barley was usually cultivated. The irrigation water comes from a transverse valley. The gravel of the screes and fans here consists of grey granite-porphry. The side valley was called *Gapu-rapdun*. It has no road. A little farther on, we are again close to the left bank of the river, at the sides of which there are several springs and swamps, everything now being covered with ice. At its right side is an extensive open plain stretching all the way to the base of the *Transhimalaya*.

At *Camp CCLVII*, the *Indus* joins the *Gartang* or *Gar-chu*, in two branches. Though the latter, as we have seen, hitherto had flowed nearer the right than the left side of the valley, it is now forced and pressed by the *Indus* to the very base of the *Ladak Range*. To look at them was quite sufficient to see which of the two rivers was the bigger. Still I made a measurement to solve definitely the question of which of the two main branches of the *Indus* was to be regarded as the real source. From the mouth of its transverse valley through the *Transhimalaya*, the *Singi-kamba* crosses the large valley diagonally, and here seems to flow in several branches in the rainy season. Even now the river was divided into two branches, not quite 800 m. from each other. At the junction the *Gartang*, on the other hand, is pressed together by the material brought down by the *Singi-kamba*, and therefore sticks to one single narrow bed. The velocity of the *Singi-kamba* is nearly twice as great as that of the *Gartang*, which also explains the leading part played at the junction by the real *Indus* branch.

In the afternoon the ice covering the three different branches, began to move and I got a very good opportunity to make the observations. Just above the junction, the *Gartang* or *Gar-chu* had a breadth of 58 m., a mean depth of 0.405 m., a mean velocity of 0.279 m., and a volume of 6.55 cub. m. per second. A little detached



LADAKIS AND TIBETANS AT GARTOK.



TIBETANS AT GARTOK





branch inside an island had the breadth of 4.70 m., a mean depth of 0.234 m., a mean velocity of 0.111 m. and a volume of 0.12 cub. m. per second. The whole *Gartang* River, therefore, in the afternoon of November 11th, 1907, carried a volume of 6.67 cub. m. per second.

The left or uppermost *Indus* branch was 27.5 m. broad, had a mean depth of 0.304 m., a mean velocity of 0.678 m. and a volume of 5.67 cub. m. per second. The right *Indus* branch was 32.7 m. broad, had a mean depth of 0.288 m., a mean velocity of 0.437 m. and a volume of 4.11 cub. m. per second. The maximum depth of the four branches was, for the *Gartang*, 0.78 m., for the little branch 0.31 m., for the upper *Indus* branch 0.51 m. and for the lower *Indus* branch 0.48 m. The *Gartang* is, therefore, deeper than the others. The *Indus* branches remain shallow on account of the greater quantities of solid material they are bringing down to its delta across the valley.

The result is, therefore, that the *Gartang* River had 6.67 cub. m., and the *Singi-kamba* 9.78 cub. m. per second. At the date of measurement, the *Singi-kamba* carried 3.11 cub. m. more water each second than the *Gartok* branch. The relation between the two source branches of the *Indus* was, therefore, nearly as two to three, the *Gartang* being only  $\frac{2}{3}$  of the *Singi-kamba*. The latter is thus the source branch of the *Indus*. It is also the longer of the two. This result perfectly agrees with my deductions in Vol. II of this work, p. 211, where I have described »The Source of the Indus».<sup>1</sup>

A measurement like this, undertaken in the beginning of November, will give a more exact idea of the capacity of the two rivers in relation to one another, than a measurement carried out during the rainy season or in the spring when the snow melts. During the winter no differences in the meteorological or climatological relations will influence the comparison between the two rivers. They live their life under exactly the same conditions. No precipitation will occasionally make the one bigger than the other. The temperature is low within both areas. All springs and smaller feeders are frozen. The situation will perhaps only be more disadvantageous for the *Singi-kamba*, in so far, that this river flows at a greater absolute altitude, and, therefore, is exposed to severer cold. Its small feeders and brooks from springs in side valleys, will, therefore, cease to deliver their tribute to the river at an earlier date. In spite of this fact, we have found the *Singi-kamba* to be the larger of the two.

On the other hand, it is very likely that the *Gartang*, during the rainy season, is the larger river, and if measurements were made every day in the course of a year, it is possible, nay probable, that the annual volume of the *Gartang* would

<sup>1</sup> Cp. also my personal narrative *Trans-Himalaya*, Vol. III, p. 45, London 1913.

prove to be greater than that of the *Singi-kamba*. The *Ladak Range* is higher and more exposed to the monsoon rains than the *Transhimalaya*, and, therefore, catches a greater amount of the precipitation than the mountains farther north-east. But, on the other hand, the drainage area of the *Singi-kamba* is much more extensive, and the average height of its level will probably be somewhat higher than that of the *Gartang*. Further: it is certain that a greater amount of snow falls on the *Ladak Range* than on the *Transhimalaya* during the winter months. The spring flood will thus be greater in the *Gartang* than in the *Singi-kamba*. From the Tibetans, it is of course impossible to get any useful information in this respect. Most of them said that both rivers were very swollen during the rainy season, and that they were of the same size. Other informants asserted that the *Gartang*, in summer, was the bigger of the two. Very likely the relation may change from day to day, depending upon the distribution of the rainfall.

When merely looking at the map, a geographical student would feel tempted to believe that the *Gartang* is the main river, and the *Singi-kamba* only a second class tributary. For the valley of the *Gartang* is much broader and does not in the least change its direction after the junction. It, therefore, seems as if the *Gartang*, being the most powerful river, dictates the direction of the joint river. But such a conclusion would be a mistake, for the *Gartang* flows in a tectonic valley, whereas the lower part of the *Singi-kamba* flows in an erosion valley piercing the *Transhimalaya* in a transverse gorge. At the very junction, it is, as I have said before, easy to see that the *Singi-kamba* is the most powerful of the two, for it forces its way diagonally across the tectonic valley and presses the *Gartang* to the very base of the *Ladak Range*, reminding the latter river, as it were, of its inferior rank of a tributary. If the *Gartang* were the more powerful, it would easily be able to keep its ground along the right side of the valley, as it does above the junction.

At 6 o'clock a. m., of *November 12th*, the greater part of the different branches was again covered with ice. Along the banks the ice ribbons were strong. In the middle, there were open passages where heaps of drift ice came down. At 2 o'clock p. m. the greater part of the ice had again begun to move, but already at 7 o'clock, ice floes again came swimming down and the rivers began to freeze for the night. After a few days the whole river would freeze from bank to bank, without any open water at all.

It may have been exceptional, but the climate at the junction was much milder than even at *Langmar*, though the distance is so short and the difference in absolute altitude nearly none. The minimum temperature of the night only fell to  $-14.6^{\circ}$ , though the next night it again was at  $-19.2^{\circ}$ . Both evenings very strong W. S. W. winds blew, coming like cascades down across the *Ladak Range*.

As *Camp CCLVII* was pitched just at the foot of this range, the latter concealed everything behind us, and only half a panorama, 359<sup>A</sup> and B, Tab. 64, could be sketched. It shows a Transhimalayan peak to the N. 42° W., being to the right of the general direction of the main valley. To the right of this peak, are the shoulders and ramifications of the *Transhimalaya*, all of moderate size, and as usual modelled by erosion and weathering. To the N. 68° E., is the narrow transverse valley by which the *Singi-kamba* pierces the system, and then crosses the whole plain to the junction. To the S. 50° E., a last top which we had passed on our way from *Gartok*, is visible.

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## CHAPTER XIV.

### THE JOURNEY TO TANKSE.

From the confluence to *Tashi-gang* we had, on *November 13th*, 12.6 km., the fall of the valley being as gradual as before or from 4,254 m. to 4,248 m., the rate being as 1:2100. The road follows the left bank of the river. The latter is often divided into two or more arms, and usually a small side branch makes a sharper bend than the main branch. The river is very broad and shallow, and it seems to have nearly the same breadth as when flooded. The erosion terraces are very low, sometimes nearly disappearing. The bank is often swampy, and a large number of springs come up, sending their frozen brooks, in gravelly beds, to the river. Old camping places are common, though now not a single tent was seen.

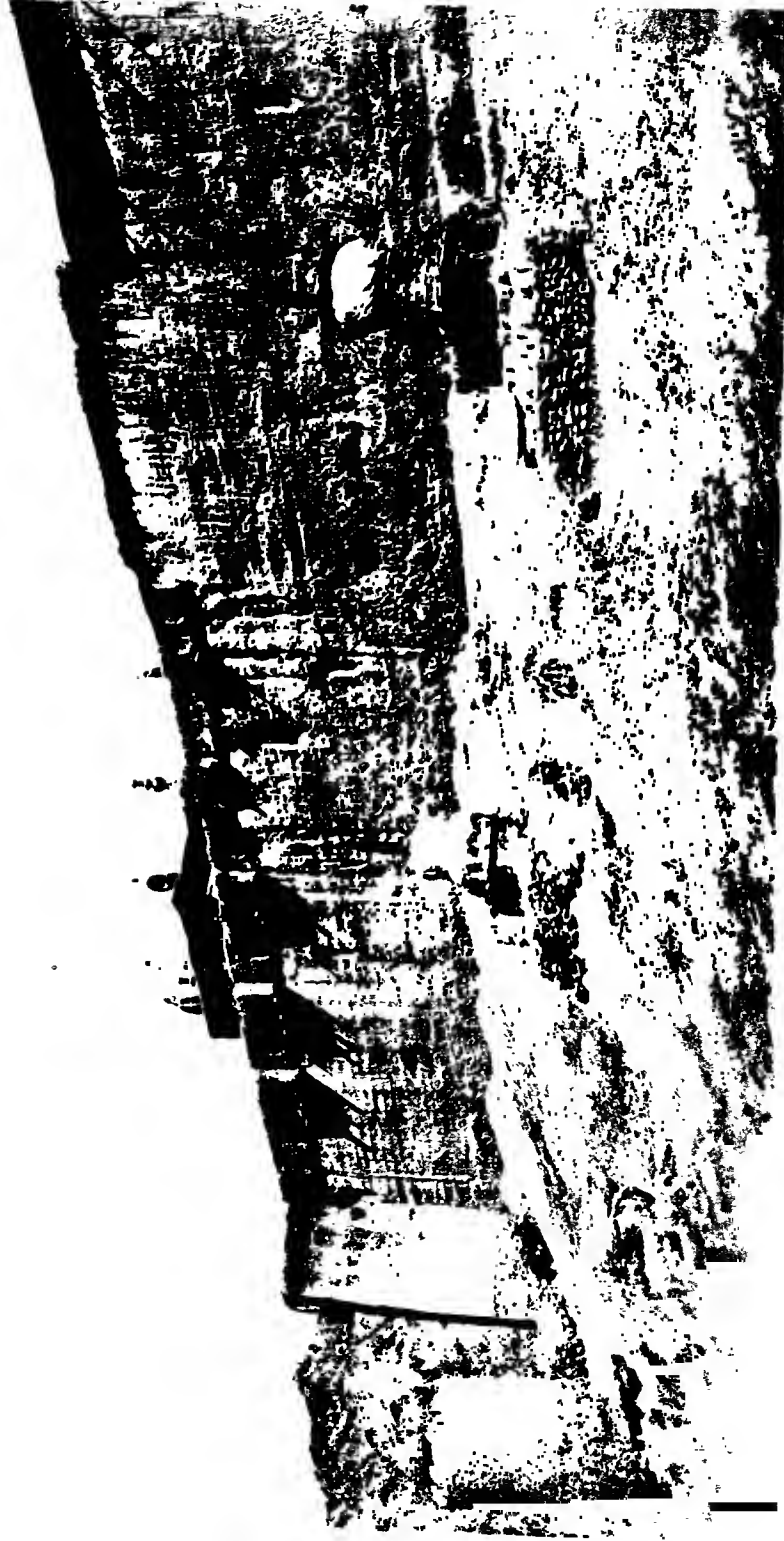
Some of the transverse valleys on the left side, had names. The first is *Shinmoralba*, with a comparatively distant perspective into the interior of the *Ladak Range*. The second is *Lunggung*, with a path to *Lunggung-la*, which can only be used by pedestrians. In the next valley is a road to *Chumurti*; its name is *Shäru-köl*. Opposite to *Tashi-gang* is the valley *Mingring*. To the left of the mouth of *Lunggung* there is a comparatively mighty gravelly terrace. At two or three places, there are cultivated fields, as usual, protected with low stone walls. Three *mani* walls indicate the neighbourhood of a temple. *Camp CCLVIII* was pitched on the left bank of the river, about 250 m. N. E. of the monastery of *Tashi-gang*, which I have described in my personal narrative.

From this camp, Pan. 360A and B, Tab. 64, was sketched. To the S. 30° E., it shows, in a foreshortened perspective, the valleys of *Tigul*, *Gapu-rapdun*, *Shinmoralba*, *Lunggung*, the peaks *Dingshung* and *Thä-tsongtsong*, the valley *Mingring* and, in the same direction, the monastery of *Tashi-gang* on its little cliff of grey granite-porphry, and the valleys *Kamlung*, *Pang-ru* and *Lungun*; all these names belonging to the *Ladak Range*. For the right or Transhimalayan side, only two names were pointed out, *Nagha-tao*, N. 44° W., and *Dongsar*, N. 25° W., both being peaks.



A GROUP OF TIBETANS





THE MONASTERY OF TASHI-GANG.





The next days' journey, on *November 15th*, 12.3 km. were made, and the fall of the valley was as gradual as before or only 4 m., as 4,244 m. was the absolute height at *Camp CCLIX*; the rate is as 1: 3075. I travelled this day with the boat at a mean rate of 3 minutes per 100 m. In the morning, half the surface of the river was covered with drifting ice. The depth in the middle of the river was, as a rule, two feet, sometimes 1 m. The water was transparent for only 1½ foot, at 2 feet the bottom could not be seen. A short distance from the point where the *Singrikamba* joins the *Gartok* branch and forces it against the left side of the valley, the joint river again returns to the right side and remains there. This fact is of interest. Above and below the junction the river follows the Transhimalayan side. Only where the *Indus* comes down from the N. E., the river is pressed to the left side. If the *Gartok* branch were the stronger of the two, it would be able to sweep away all the solid material brought down by the *Indus*, and even at the junction, remain along the right side.

The course of the joint river is very straight, its windings being insignificant. Sometimes the stream washes the right mountain base, where at some places blocks have fallen down into the bed. The form of the river bed is extremely regular the whole way, depth and velocity being nearly the same. Only in the inner vertex of a few windings, a hardly audible murmuring of water may be noticed, otherwise the river is perfectly silent and glides like oil, slowly down its bed. The erosion has here arrived at a state of perfection that does not permit the existence of the most insignificant rapids. Only at places where we drive along the rocks at the right bank, there is some difficulty in steering the boat between the blocks. These rocks consist of green, black, brown and yellow crystalline schists. The bed is bounded by terraces 3 or 4 m. high, occasionally interrupted by tributaries. At the right side, the terrace even rose to 7 m. at a few places. The valley is very narrow. The mountains to the left, the *Ladak Range*, are higher, and as hitherto the fans of their gorges press the river up against the Transhimalayan side. Only one Tibetan was seen, building a long row of small stone cairns and joining them with ropes, for hunting antelopes. Twice two individuals of *Ovis ammon* were seen on the slopes to the right. Besides these, we only saw a fox and numerous ducks. At one place tame yaks were grazing.

*Tashi-gang* had early disappeared, being hidden by the unevenness of the ground. *Pa-taö-sang* is a broad and open valley to the right, in which there is a road to *Rudok* three days' marches in length. In its background, a red mass indicates the crest of the range. *Kalosh* is a transverse valley to the left. The district of *Camp CCLIX* was called *Tarae-kongma*.

On *November 16th*, we had 11.5 km to *Demchok*, which is situated on a hill at the left side of the river, its altitude being 4,274 m. The slope of the valley is

the same as before. In the night we had a change of weather. A strong S. W. wind was blowing, carrying masses of clouds across the *Himalayas*. Every distant view was hidden by clouds, and heaps of dust, sand and rubbish came whirling through the valley. The minimum temperature was only  $-5.9^{\circ}$ . Therefore, the river carried much less drifting ice floes than usually. The valley is narrow, its ground covered with gravel of grey granite and very undulated. The road, therefore, goes up and down more than hitherto. The river remains pressed against the base of the right mountains with great force. Sometimes old terraces, deformed and destroyed by wind and weather, are seen at the slopes, about 25 m. high. The soil is barren, and nearly no grass was seen along the river. Numerous springs send out long ice ribbons in ravines and small side-valleys. Several *mani* walls are passed.

Approaching *Demchok*, the valley becomes somewhat broader. At the right side, a mighty red group, with steep slopes, begins and continues beyond *Demchok*. Along the right bank of the river, there is now a terrace 10 m. high, perpendicular and consisting of reddish brown pebbles and shingle. Near *Demchok*, a little hill, *Tsänmo*, is adorned with a *hla*, and here begins a series of *mani* walls of the usual *Ladak* type. *Demchok* is a little village of some 4 or 5 stone and earth huts, surrounded by a few barley fields.

From *Tarae-kongma* to *Demchok* the following names were mentioned: *Chume-kamlung*, is a transverse valley from the *Ladak Range*. The district where it enters the main valley is called *Tara-yogma*. *Pu-tarhip* and *Öserding* are tributaries to the left. On the same side, follow *Tama-chera*, *Karbun-därchu*, *Chamo-sesa* and *Tselung*. From the right side, enter the tributary valleys of *Yimege-sang* and *Tavuk*, the latter being a broad but short valley receiving several tributaries from the sides and having a comparatively mighty, red, rocky group in its background. From *Demchok*, the two small panoramas, 361 and 362, Tab. 64, upwards and downwards in the *Indus* valley, were sketched.

On *November 17th*, we had 28 km. N. W. to *Camp CCLXI* at *Nagankal*, where the height is 4,229 m. On the way the little threshold, *Tutang-la*, is passed, with a height of 4,333 m. From *Camp CCLXI* *viâ Demchok* and to *Camp CCLXI*, a distance of 39.5 km., the valley falls only 15 m. or at a rate of 1:2633, showing the same regular and extremely slow slope of the upper *Indus* valley.

A short distance N. W. of *Demchok*, the road passes a partly frozen brook coming from *Demchok-pu*, a tributary valley from the left. A miserable stone bridge is built across the watercourse. At the left side of the mouth of this little valley, are the ruins of two or three houses, which were said to have belonged to *Hemigompa*. A pyramidal peak at the same, or left side of the valley, is called *La-ri*, and said to be sacred. The valley, *Demchok-pu*, itself is regarded as the boundary between *Tibet* and *Ladak*.

In the same neighbourhood the road, readily visible among the gravel of the ground, goes down from the terrace or hill slope on which *Demchok* is situated. *Kurang-gungpa-sang* (or *-ngungpa*) is a considerable tributary valley from the right side, by which one day's march leads to the little village of *Chagang*, where barley is cultivated. The main valley now becomes broader and resembles a little plain, called *Tedor* or *Tetar*. Climbing a little slope, the road, on its other side, comes down to the river, which here, along its left bank, has a terrace 8 or 10 m. high, perpendicular, and consisting of sand, pebbles and shingle in horizontal layers. One third of the surface of the river is covered with floating ice, and along the banks is ice, under which the fishes take refuge. The mountains of the Trans-himalayan side are steep, wild, rocky and of a red colour; there is no snow. The river here makes a bend to the west, north, N. E. and N. W. flowing on the eastern side of a little ridge, called *Kardong*, on the top of which are the ruins of stone walls, perhaps an old fortress. To our left are the valleys and districts of *Tso-unlung*, *Kamlung-chun*, *Umlun* or *Unglung* and *Tselung*. The ground is again gravel and sand, and the road is excellent, crossing a wide plain in the valley.

Now we slowly ascend to the little threshold, *Kamlung-karnak*, at 4,302 m. Between the road and the river is the prolongation of the red and irregular ridge of *Kardong*. On the threshold and N. W. of it, the living rock is greyish blue marble, assuming a reddish colour if weathered. Beyond the pass several dry water-courses gather from all sides, forming a tributary strong enough to break through the red ridge at our right. Its valley is called *Nayagnik*. Through its opening, the *Indus* is again visible, and along the right side of the river, the massive red range mentioned above. The *Kardong* Ridge continues the whole way to *Camp CCLXII*, and divides the valley into two halves. In the S. W. of these, the road runs like about 50 parallel paths, straight N. W.; in the N. E., half, is the *Indus*. The whole country here is as barren as a desert; there is no grass, no bushes, no animals, no water. *Sinak* is a little valley from the left. *Benda* is the name of the plain S. E. of the next threshold. *Sikar* is a valley from the left. *Lungpa-karpo*, *Taglung* and *Chungtung* or *Jung-chung*, the next. To our left is an ice-sheet, from which we slowly go up to the little pass, *Tutang-la* 4,333 m. high. There are properly two thresholds, one with a *mani* and the other with a cairn and rags on a pole. From here the view to the N. W. is magnificent. For five days' journey and more, the tectonic valley is quite open with its innumerable ramifications and mountain shoulders projecting in an endless perspective, and far in the background are snowy mountain giants in light blue colours. Beyond the pass to our right, three names were noted: *Ghu-ton*, *Rayung-karu* and *Na-gangkal*. Here *Camp CCLXI* is located, near a frozen brook coming from a spring. Some bush vegetation was also found at the place.

On *November 18th*, we continued N. W. for 12.9 km. descending imperceptibly as before, though at a somewhat faster rate or 1:331, the difference of height being 39 m., *Camp CCLXI* being at 4,229 m. and *Camp CCLXII* at 4,190 m. The road crosses a plain called *Gaptut*, in a straight line. From *Camp CCLXI*, a bend of the river is visible, and its valley is here called *Chogo-sang* and *Ngaga-ngota*. *Tsotpo-rap* is the plain between the two valleys, that of the road and that of the *Indus*. After this the river is hidden again. To the left, are the tributary valleys of *Tovo-karu*, *Tsa-kang*, with a yellow projecting rock, *Arka*, and *Nayakbö*, in the mouth of which is the little village of *Kuyul*, inhabited by 12 families. *Tsokgerash* is a belt of vegetation to our left. On our right side we have the passages, *Pugäp-kongma* and *Pugäp-parva* across the ridge, and *Semgo*, a belt of vegetation. *Puktse* is a yellow rock of fine-grained marble at the left side of the transverse valley, by which the *Indus* again returns to our valley. The *Gaptut* plain is as even as the floor of a room, and its soil consists of hard sand, soft detritus, sand or very fine material brought down by rainwater and now forming large surfaces as even as a frozen lake. The ground is perfectly barren until the camp is approached.

From *Camp CCLXII*, Pan. 367A, B and C, Tab. 65, was taken. On this some new names are entered. To the N. 44° W., it shows the endless prolongation of the valley with a mighty snow-covered mass in the background. *Manlung* is a peak to the N. N. W., and *Kugu-nara* is N. 12° E. In the same direction is the transverse valley by which the *Indus* returns to our half of the valley. The mountains to the left of the piercing valley, were called *Ngang-sang*. *Puktse-ri* is the group N. E. of *Puktu* or *Camp CCLXII*. Farther to the right, is *Nagerum*, and about S. 70° E., *Pugäp*. *Umbo-mane* or *Ombo-mani*, *Chu-loa* and *Ngoku-la* are mountains belonging to the Transhimalayan side. To the S. 26° E., is *Kamlung*, a mountainous region, and S. 6° W., the tributary valley of *Kuyul*. To the S. 21° W., is a dominating pyramidal peak beyond which *Hanle* is said to be situated, though this place is in reality to the S. W. *Chamarta*, pointed out to the S. 35° W., is probably intended to mean *Chumurti*, which is to the south. Finally, in the *Ladak Range*, there follow the regions, and probably passes, of *Chang-lung-kongma* and *Chang-lung-yogma*, being the same names as we had found before in the *Kara-korum* System.

On *November 19th*, we had a march of 16 km. N. W., the ground sloping in the direction of the road from 4,199 to 4,186 m. or at the rate of 1:1231. In this section the river flows generally in the middle of the valley, or perhaps a little nearer its left side. The road is very straight along the base of the *Ladak Range*, and from time to time it touches the left bank of the *Indus* which is very winding. The ground consists of fine dust, partly barren, but as a rule, bearing some grass and, along the river, bush vegetation. Occasionally silt and other fine material has been brought down by rainwater and form perfectly level patches. There is no kind

of undulations of the ground. To the naked eye it is perfectly horizontal. Sometimes we cross belts of coarse sand, the last remains of the destruction of the rocks. But never even a rudiment of a dune of drifted sand, is seen. In profile, the floor of the valley between the base of the screes to the right and left is a nearly perfectly straight horizontal line. It is easy to see how complete and even the filling up of the space between the two ranges has been. This is the result of wind, weather, rain and erosion, and the work of filling continues day by day. The action of transport, on the other hand, is not great. Only during a limited part of the year, the *Indus* carries away solid material in a very fine state of division. By far the greater part of the material washed down by the water, remains in the valley. This procedure continuing for thousands of years, will finally succeed in making the valley as even as a floor. Only where the screes meet one another, the ground becomes undulated.

We pass *Kugu-nara* to the right, and *Lungsor* and *Lungbo* to the left. *Mane-tumtum*, situated on a bend of the river, is a *mani* wall, very well built, partly of masonry, and covered with engraved stones with the usual formula. Then follows a whole series of small *manis*. Now there is a good deal of grass and bushes along the river. The road is following the base of the mountains to the left, and so is the river in this section of its course. Sometimes it is divided into two branches. *Manlung* and *Dumtse* are valleys to the right. Where the valley, *Ringtung-nana*, enters from the left, we cross the river, which here is covered with very solid ice. The breadth of the stream was here 78.7 m., the mean depth, 0.46 m., the maximum depth, 0.78 m., the mean velocity, 0.357 m., and the volume 12.98 cub. m. per second. Eight days before or on November 11th, we had found the volume to be 16.45 cub. m. per second. Now the river had, therefore, 3.47 cub. m. less. This is due to the severe cold in the mountains of the higher regions, more and more spring-water being bound as ice. This diminishing of the volume, would, no doubt, continue in the course of the winter, though, of course, not at such a rate as during these last eight days. Lower down it comes to a point where it begins to increase, by means of the water brought down by tributaries. *Camp CCLXIII, Dung-kang*, was situated on the right bank. From here, two small panoramas were sketched, 363 and 364, Tab. 64, the first to the N. E. and east, the latter to the N. W. showing the high mountain group beyond *Chushul*.

On *November 20th*, we made 17.3 km. N. W., sinking from 4,186 m. to 4,179 m., or 7 m., which is the same as 1:2471. The fall of the valley is, therefore, still insignificant, and it would be impossible to tell whether the ground descends or ascends, if we had not the river at our side. The landscape remains extremely monotonous. In the large features there are no changes whatever; two ranges with innumerable shoulders and short, steep ramifications, screes and fans, transverse

valleys, and one large valley in the middle with the river winding its course from one side to the other. Even the direction always remains the same, and the effects of the sunshine is, therefore, the same from day to day. In the background, rises the same snowy mass that we have seen for several days, and we seem to approach it very slowly. All the way from *Gartok*, there is always nearly the same view, the same relief. The laws of erosion have caused the same features of morphology. At both sides, the mountains have about the same height the whole way, without being interrupted by high snow-covered and dominating peaks. Only in the mountains to the left, the *Ladak Range*, there are some patches of snow in shadowy places near the crests, but in the mountains of the Transhimalayan System, we did not see any snow at all the entire way. From the floor of the valley, it is, as a rule, difficult to tell how far it is to the culminating crests on both sides. Only through the openings of the larger tributary valleys, one becomes aware of the crest. On the section to *Camp CCLXIV*, the floor of the valley is as even as before. The soil is fine material and clay; grass and bush vegetation is more abundant than hitherto. Sometimes the path goes through a real jungle. Rabbits' holes are numerous. Ducks are still living where springs keep the river open for a few meters or more. All the rest of the river is covered with solid ice. There is again a series of *mani* walls. The road is, as a rule, quite near the river, only twice its course is out of sight, *Gangra-kongma* and *Gangra-yogma* are tributary valleys from the left. At *Tavuk*, we pass by three miserable tents and a low wall of sun-dried bricks. *Tabukam* is a valley to the left, *Pelung*, from the right. In the background of the latter, is the district of *Dungsum*. Here a ridge of low hills begins to our right, and continues the whole way to, and beyond the next camp. Therefore, the even floor of the main valley becomes more narrow than before. At the foot of this ridge, is a steppe of grass and bushes on sandy soil, and there are several *mani* and ring-walls. The river sweeps along the base of the ridge and is open at a few stretches. But even at such places, there is always a belt of ice along the banks, sloping towards the middle of the river, which proves that the volume of water is constantly decreasing. Solid rock is never within reach. The detritus of the little ridge consists of grey quartz-biotite-diorite and green sandstone. At *Lung-kung*, *Camp CCLXIV*, the river is nearly open, and flows slowly and noiselessly along the base of the *Ladak Range* towards the transverse valley by which it pierces this range. From this camp, Pan. 368, Tab. 65, was made, showing some of the mountain shoulders to our left, and in the background, as usual, the snowy mass to the N. 38° W.

On *November 21th*, we travelled 24 km. N. W., and now finally a change is entering along this monotonous road, for we leave the *Indus Valley*, though still following the same tectonic valley as before. Therefore, we slowly rise again.



CAMP 264, THE LAST ON THE INDUS.

*Camp CCLXIV* was at 4,179 m. and *Camp CCLNV* at 4,449 m., meaning a rise of 270 m. or at a rate of 1:89. It is to be noted that during the first 10 km., the ground continued to fall, so that the rate of ascent was in reality somewhat steeper than 1:89.

During the last days, we had experienced a strong W. S. W. wind, but only at intervals and very irregularly and influenced by the mountains. I had the impression that the strong and regular W. S. W. wind that last winter had killed our animals on the *Chang-tang*, had not yet set in. It may, however, be that it does not develop all of its energy until it reaches the high open plateau of the *Chang-tang*.

*Nesurma* is a tributary from the left, *Gyon* and *Lungun*, valleys to the right. After crossing a cut-off bend of the river, the latter disappears from sight, and only a last glimpse of it is caught when it pierces the *Ladak Range*, with a peak called *Dungti* at its right. The bush vegetation ceases completely, but the grass steppe continues, occasionally interrupted by small patches of nearly barren violet, hard sand. In the mouth of a broad valley to the right, sand dunes have formed, reaching fairly high on the slopes of the surrounding mountains. In the main valley, there are no wandering dunes, only very low undulations of sand bound by grass. The soil then becomes soft and more uneven as it is modelled by wind erosion. In the background of the transverse *Indus* Valley a snow mass of moderate height is visible. So far as can be seen, the transverse valley of the *Indus* is directed to the S. 55° W., after which it again turns N. W. with the *Ladak Range* to its right.

Having crossed a dry watercourse from the left side, we begin to ascend the slowly rising slope of a barren scree of sand with fine gravel on its surface. Its boundary is very sharply drawn. To our left the belt of vegetation continued for some distance. To our right, is a little patch, like an island, of grass and bushes called *Tama-yaghgang*. The road is comfortable, crossing absolutely barren ground. The snowy mountains of *Panggong-tso* are hidden by the rising ground in front of us. The erosion bed of the valley becomes deeper and narrower and its terraces more developed as we proceed. The right one is the best developed. At the point where we cross the stony bed, there is some vegetation. Some *manis*, called *Salme-mani*, are again passed. Here the height is 4,272 m.

The valley becomes narrower but runs straight N. W. as before. A glimpse backwards to the S. E. now shows us an endless perspective of the *Indus* Valley. Its floor has a yellow colour between the mountains, but the river cannot be seen. *Lungnak* is a valley to the right.

To our left is the little village of *Salma* with its low stone huts, walls and barley fields. It gets its supply of water from a spring, forming ice-sheets. In the bed of the main valley there is also some ice. The soil is now covered with gravel



and small blocks of granite. A new series of *manis* is passed before we reach the swamp and grazing ground of *Dung-lung*.

On *November 22nd* our road turns a little N. N. W. The distance to *Chushul* is 33.5 km. From *Dung-lung*, *Camp CCLXV*, 4,449 m high, we have 4.2 km. to the pass, *Tsake-la*, 4,653 m. high, the rate of the ascent being as 1:20.6. *Chushul*, *Camp CCLXVI*, is at 4,359 m., or 294 m. below the pass; the rate of the descent is here as 1:100. With swampy ground, some vegetation and a *mani* wall to our left, we follow the comfortable path along the erosion furrow from the pass, and reach the flat and easy *Tsake-la*, adorned with a cairn, poles and rags. It affords an easy passage from the *Indus* to the *Panggong-tso*. The view is not imposing. The valley on the N. W. side is broad and open and runs in a nearly straight line to *Chushul* and *Panggong-tso*. In its background the snowy mass is always visible. It is the mighty range on the S. W. shore of *Panggong-tso*. The mountains on the northern shore of the same lake rise to the right and a little farther away than the first-mentioned group. On the pass we had a fresh S. E. wind and a temperature of  $-4.5^{\circ}$ , after  $-10.3^{\circ}$  in the night. Later on we had a N. N. W. wind, increasing towards evening.

From the pass we go slowly down along the base of the left mountains, where there are large numbers of springs, stone walls, grass and bushes in stripes. From the left side a series of tributary valleys enter, among others *Chushag-kongma*, *Chushag-yogma* and *Lungun*. The range to our right is low, and has only very small valleys. One of them has a road leading to *Rudok*. *Argha* is a valley from the left. Here is the *mani* cairn *Arge-lato* with heaps of horns, poles and rags. The rock consists of grey, porphyric quartz-biotite-diorite. The floor of the valley is very even and hard and, nearly everywhere, barren. Only occasionally there are small patches of vegetation. The road generally runs in the middle of the valley. The last part of it runs along the left mountains. *Boplsang* is a tributary valley from the left. The main erosion bed of the principal valley sticks to its right side. *Morghu-naga* is a broad valley to the right, in which there is a road to *Pangur-tso*. *Rallamor* is a valley from the left. Riding along the base of the hills, we have the wide, yellow plain to our right, with extensive ice-sheets here and there.

At *Chushul* a little brook joins the main watercourse of the valley and goes with it to the *Panggong-tso*. The mountains to the north of the lake are visible. Near *Chushul* we had passed four large *mani* walls indicating the two *gompas* of the village, one of them old and situated at the foot of a hill, the other new and built on the top of the hill. The village has 25 small houses, barley fields and some trees. At *Chushul* the climate is much milder than in the *Indus* Valley and the other places we had left behind.



NATIVES TRAVELLING IN THE DISTRICT OF YUMBA-MATSEN.



On *November 24th*, we travelled 23.3 km. N. W. We had 11.2 km to the pass, *Kongta-la*, 5,061 m. high, an ascent from *Chushul* of no less than 702 m. and at a rate of 1:16. From the pass to *Camp CCLXVII*, was a distance of 12.1 km. and a difference in height of 284 m., the latter place being at 4,777 m.; the rate of fall is here 1:43. We cross some small irrigation canals and a brook from a spring, now open, and pass some *mani-rigmos* with inscribed stones, after which our road rises towards the pass. On our right we now have the mighty snow-range we had seen so many days, and which stands on the S. W. shore of *Panggong-tso*, but now its snow-fields are hidden by lower slopes, shoulders and ramifications. Here a caravan of 500 sheep was met with, carrying barley to *Rudok*. Otherwise the country is as lifeless as before. The road runs at some height above the bed of the principal watercourse of the valley from the pass which we have to our left the whole time, and which is called *Ar*. To our right are mighty mountains of grey quartz-biotite-diorite, eroded by several transverse valleys, with gravel and blocks in their beds. On the S. W. side of the *Ar* valley, there is the black, wild and rocky *Ladak Range*. In the background of the upper *Ar*, we have a high snow-covered mass belonging to this range, and at its left side, west of the pass, is another mass that had been in sight for a long time. In the valley itself there is a winding ice-brook and on its sides, some grass.

Approaching the pass the road crosses two or three deep-cut valleys from the mountains to the right, filled with gravel and boulders. They join the *Ar* valley which keeps close to the base of the black rocks of the *Ladak Range*. On the top of *Kongta-la* is a large cairn with poles, horns, rags and streamers. Wind-worn boulders of quartz-biotite-diorite lay on the saddle. The slope down from its N. W. side is gradual and the comparatively broad valley continues between the black rocks to the left and the grey to the right. Above the rocky crests of the latter, snow-patches now appear. The watercourse is dry and shallow. The soil consists of coarse sand and gravel, the road is good. *Tasang* is a large tributary valley from the S. W., in the background of which a portion of the *Ladak Range* again appears. Four tents were pitched in the middle of the valley, and at *Kongma-lung-kongma*, *Camp CCLXVII*, there were two. In the high regions of the rocks N. E. of that place, was a little hanging glacier.

On *November 25th*, we travelled 30 km. N. W. As *Camp CCLXVIII* has a height of 4,411 m., we again descended 366 m. or at a rate of 1:82. Leaving the camp, we cross the valley diagonally, also two dry watercourses, after which we descend among heaps of gravel and blocks. The principal watercourse of the valley is to our left; it is frozen, but we hear the murmuring of water below the ice. From the left, the valley *Puryok* enters, from the right, *Kuni*. Occasionally ice ribbons come down from the sides. The mountains to our right are rocky and wild and

their peaks covered with some snow. The terraces of the principal bed are 3 m. high. At the side valleys *Parma* and *Datt*, the main valley opens like a little plain and the fall becomes very gradual. The soil is swampy and there is some grass. Several *manis* and *chortens* are built here and at other places along the road. Near the valley of *Dungting* to the right, a tent is passed. The valley then again becomes narrow. The road here follows the erosion bed at the base of its right terrace. Opposite the large valley, *Lalung*, on the left, the bed is crossed on its ice, the water being only one foot deep. A ruined bridge has been built across the *Lalung*, showing that it may carry much water in the summer. *Kongchu* or *Kongyu* is the name of a nice *hla* or cairn with streamers and horns.

From the left enter the extensive valleys, *Solung* and *Gorlung*, from the right, *Lungser*. The main valley is again broad and open, and the road runs along the left bank of its watercourse. Just below the mouth of the *Gorlung* valley, there is a little village of two or three huts. The rocks to the right side of the valley consist of very weathered porphyritic specimens, those to the left of dark hypersthenaugite-diorite. Near the base of the mountains on the left side, is a shallow pool, called *Salsal-tso*, formed chiefly by an abundant spring of  $+5.2^{\circ}$  temperature; only its western part was frozen. A short distance beyond it, we had our *Camp CCLXVIII*, *Sara* or *Lung-yogma*, where the large valley of *Belmik* enters from the left. Two *Rudok* caravans had been met in the course of the day.

On *November 26th*, we made 22 km. N. W. and north to *Tankse*, descending from 4,411 m. to 3,990 m. or 421 m. which gives a rate of 1:52. The road leads across a little secondary threshold, 4,578 m. high, at the right side of which the brook has a deep-cut bed, like a gorge deep below our feet, when standing at the cairn of the threshold. Beyond the right tributary, *Amsit-langpo*, the road follows the detritus scree of the left side of the valley with a very steep slope. Here we are 100 or 150 m. above the bottom of the valley where the ice ribbon of the river winds, only occasionally with some open water in the middle. After a while the road again leaves the river at some distance to the right and descends between hills of detritus and blocks. The landscape is wild and picturesque. One has a strong feeling of having entered the peripheric regions with outlet to the ocean, the boundary being the *Kongta-la*. Here the morphology is wild and accentuated, not uniform and monotonous as on the *Chang-tang* or even in the upper valley of the *Indus* which, in spite of being peripheric, still keeps the features characteristic to the regions without outlet to the ocean.

At the village, *Herat*, with a few stone huts, walls, *manis*, *chortens* and fields, the road crosses the valley to its right side. At *Chilam*, a village, the brook is crossed on a poor bridge. The terraces are some 20 m. high on the sides of the principal brook and in the tributary valleys. *Skamlung*, *Shälchu-kul* and *Taruk*

are large valleys from the left. These valleys from different directions, join in the sharp bend where the main valley turns to the north and N. E. On both sides there are wild steep rocks of very picturesque forms. Heaps of gravel, blocks and boulders fill the valley. The brook increases and is nearly perfectly free from ice, foaming in continuous rapids in its stony bed. The valley is very narrow, but there is still room for small cultivated fields and a few huts. Here are many well-built *manis*, some of original form. The valley turns more and more to the right, and finally we reach *Tankse*.

Here the first part of my journey in Tibet in 1906—1908, came to an end, and the great ring was closed. I had left *Tankse* on *August 21st* 1906, and now returned there on *November 26th*, 1907, the journey thus having taken one year, three months and seven days. Here we have, therefore, a means of controlling the exactitude of my field map, disregarding the astronomical observations and all other corrections from determined points, amongst which those of Ryder are the best. Colonel H. Byström has made such a graphic examination by joining all the 26 sheets which were constructed by Lieutenant C. J. O. Kjellström to the scale of 1:200 000. Drawing my field maps I only made use of compass and watch and determined the distance by means of the length of the paces of my riding pony. Under such conditions as those in which this journey was made and which have been described above and in Vol. II and III of this work, one would expect a very large error. The continual winter storms, the cold, and the sometimes unfavourable ground, would very likely make the field map uncertain. My several crossings of the *Manasarovar* were, however, omitted, but the crossings of Lakes *Lighien*, *Yeshil-köl*, *Pul-tso* and *Ngangtse-tso*, as well as one days' journey on the *Tsangpo* and one on the *Indus* had to be included in the graphical calculation of Colonel Byström. Along the route of my fieldbooks, from *Tankse* and back to *Tankse*, he got a distance of 4,270 km. On the construction the length-error proved to be 109.5 km. or 2.56% of 4,270, and the cross-error 1.52%, which may indeed be said to be a satisfactory result. Or, in other words, for a distance of 100 miles I would get, as an average, 102.56 miles. On the map in 15 sheets in 1:1,000,000, accompanying this work, Colonel Byström has tried to bring my field survey as much as possible in accordance with all other data existing.

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THE SECOND CROSSING  
OF THE CHANG-TANG





## CHAPTER XV.

### A NEW CROSSING OF THE KARA-KORUM SYSTEM.

So far as to a point situated 17 km. W. N. W. of *Camp CCLXXX*. I had followed the famous caravan road of the *Kara-korum* Pass, the same one that I had used on my return journey from India in 1902. Thus leaving the road of the *Saser Pass* to our left and the valley of the *Shayok* River with the *Kumdan* Glaciers, situated at a short distance to the N. W., we entered, on *December 17th* 1907, a little side valley coming from the N. E., obviously the one in which the so called *Murgho* road passes, which is used at periods when the common, more western, road is closed by the *Kumdan* Glaciers. This tributary valley to the *Shayok*, joining the latter from the left side, is very curious. It is a narrow gorge, bounded by steep, sometimes perpendicular, rock walls, and winding in all directions. Its whole floor, from one side to the other, was now filled with compact ice, sometimes transparent like glass, sometimes white like milk. Only occasionally there is a little stripe of coarse sand or gravel at the sides which has not been reached by the ice. The fall of this valley is so gradual, that the ice-sheet seems to be nearly horizontal. Only at one single place, open water was seen. The cold was severe after being  $-24.6^{\circ}$  in the night, and everything was frozen. Finally we enter a little side valley from the left, also filled with ice. On the slope at its right side, where the region is called *Long*, we had our *Camp CCLXXXI* alongside of a caravan from *Yarkand*. Here the height was 4,663 m.

On *December 18th*, we marched 11.3 km., E. S. E. To begin with, we have to cross a little flat threshold, east of which there is a pool. The road to *Yarkand* is clearly visible nearly everywhere, and even if it were not, it would betray its existence by the 63 dead ponies, most of them fresh, which we passed in the course of the day. North of the road is a wild red rocky ridge with cliffs and peaks and stripes of snow. E. S. E. of the pool, is a second flat threshold 4,731 m. high and called *Chong-tash* or »The Big Stone«. To the south is a more rounded and less rocky dark range. On its northern slopes, there was a good deal of snow. From the second threshold, a narrow, dry watercourse, between terraces, goes down to the

springs, simply called *Bulak*. Here, *Camp CCLXXXII*, the height is 4,544 m. Simultaneously with our arrival, there came a caravan from *Yarkand*. The cold was intense. The last night it was  $-31.4^{\circ}$ . Twenty dead ponies were counted around the springs.

On *December 19th*, our direction is N. E., east and north to *Burtse* or *Camp CCLXXXIII*, where the height is 4,808 m. or 264 m. higher than the previous camp. The ascent is, therefore, as 1:74, the distance being 19.5 km. The temperature in the night was down to  $-27.7^{\circ}$ . The day's march takes us up through the *Murgho* valley proper, and the little valley from the second threshold of the previous day was a right tributary of *Murgho*. *Bulak* is situated at about 1 km. from the junction. There is no possibility of marching in the bed of the lower course of the *Murgho*. It is as narrow as a corridor, filled with ice and blocks. Therefore, the road climbs the slopes on the right side, which, at their base are perpendicular and even overhanging with long icicles like stalactites hanging down from the edge. The water comes from springs on the slope. On the latter, we have to climb some 279 m. or to 4,823 m., from where we again go down to the bottom of a little tributary from the right, having considerable terraces of pebbles and shingle. Everywhere there are the corpses and carcasses of fallen ponies, proving that this horrible passage is the high road to *Yarkand*.

From the point where the *Murgho* valley joins the little tributary of *Bulak*, the joint valley is seen, piercing the mighty snow-covered mountains to the south in a direction of S.  $60^{\circ}$  E. after which it turns S. E. and south, and finally joins the *Shayok* valley at the point where we had our *Camp CCLXXIX*. From the latter camp, I had, on *December 16th*, made an attempt to force this eastern short-cut road of *Murgho* as the Ladakis called it. We had ascended the valley northwards from *Camp CCLXXIX*. After about 2 km., we came to a point where two valleys join. The one from the N. W. is the one which we later on saw from the hills near *Bulak*, i. e. the lower course of the *Murgho* valley and it is impracticable for caravans. In the one from N. N. E., we ascended about 1 km. to a point where this valley was hopelessly closed by blocks, as large as houses, which had fallen down from the rocks at the right side. Only on foot, would it have been possible to proceed this way. Therefore, we had been forced to make the long roundabout way to *Camps CCLXXX, CCLXXXI* and *CCLXXXII*. My wish was to reach the height of *Chang-tang*, the sooner the better, so as not to be forced to travel too far north. For the goal of this second crossing of Tibet was to reach the *Central Transhimalaya*. It proved to be a very difficult task to get out of this trying labyrinth of *Kara-korum* valleys.

However, we were now on our way from *Bulak* to *Burtse*. From the little right tributary just mentioned, we entered the *Murgho* valley, marching partly on

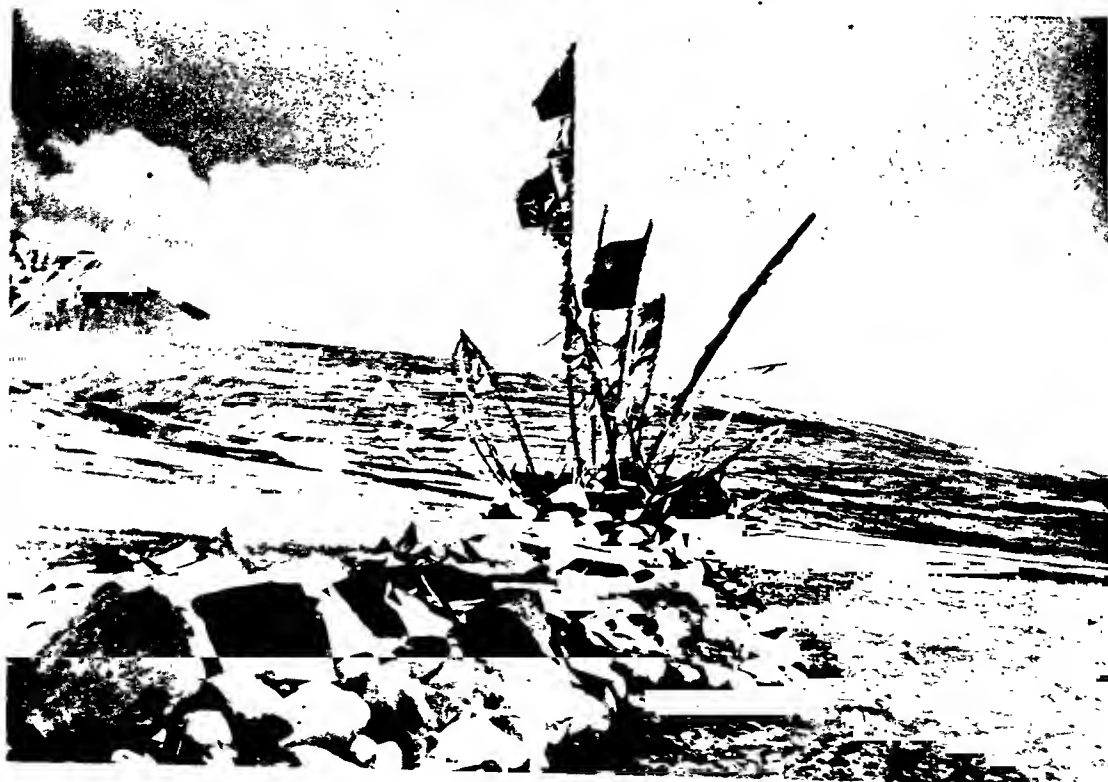


NATIVES OF TERI-NAM-TSO.



NATIVES TRAVELLING IN WESTERN TIBET.





VIEWS FROM SOUTH-WESTERN TIBET.



its right terrace, partly on the ice. Here was no open water. The road then climbs the steep slopes on the left side, where everything is covered with snow. The road is good, but if a pony slips, he is lost. At 1 o'clock p. m. we had a temperature of  $-17.6^{\circ}$ . The landscape is very picturesque. After a while we again go down by hundreds of zigzags, to the floor of the valley, where there is now neither ice nor water, only snow among the gravel. Then the road climbs the right slope, from where it goes down, crossing the main valley by a bridge, partly built, but mostly consisting of gigantic blocks in the bed. Finally we are able to keep to the gravelly floor of the principal valley where hard and compact snow fills all erosion beds and sometimes is covered by a thin layer of wind-driven dust and red sand. The valley turns to the N. E., north and N. W. From the left or east, several tributaries enter, but none of them looks promising for an attempt straight to the east. The valley is perfectly barren. Grass is seen nowhere. At *Burtse*, *Camp CCLXXXVIII*, the name seems to indicate that a plant called *burtse* is to be found. Now nothing except snow could be had at this place.

If it were true, as my Ladakis asserted, that *Burtse* would be only two days from the *Kara-korum Pass*, we ought to have another pass in the same range east of *Burtse*, and at a distance of less than one day's march, as the range runs N. W.—S. E. But nobody among my Ladaki servants knew whether the valley which comes from the N. E. and joins the *Murgho* valley at *Burtse*, leads to such a pass, equivalent to the *Kara-korum Pass*, or not. So far as one of my men had been reconnoitring in the early morning, the passage was good, but he could not go sufficiently far up towards the crest. Still, in the hope of making a short-cut up on the *Chang-tang*, I decided to make an attempt. We were also lured by tracks of ponies readily visible, both in the gravel and in the snow, and, therefore, only a few weeks old.

On *December 20th*, we started for this, as far as my Ladakis knew, nameless valley. The distance to the uppermost point we reached was 16.6 km., and the altitude of the same point, 5,040 m. or 232 m. above *Burtse*, giving, therefore, the very moderate rise of 1:71. From this point to the crest of the range which must be very near, the ascent must be steep. The night had been perfectly clear and the cold severe,  $-29.1^{\circ}$  at 9 o'clock p. m., and  $-35.3^{\circ}$  as a minimum.

About half of the valley was snow-covered, the rest gravel, and higher up, ice from springs. The valley is enclosed between wild, rocky mountains. From the base of the living rock, steep screes slope down to the floor of the valley where gigantic blocks and boulders sometimes have fallen down. At a few places, the passage is very narrow. Higher up it is a gorge so narrow that one may touch the rocks at both sides simultaneously, which means hardly 2 m. We continued until we reached a place where the narrow passage was blocked up by boulders



and blocks that had given way and fallen down, quite filling up the narrow space. Here we could have forced our way. But a short distance farther on, a similar fall of rocks had taken place which could not be traversed without straining the forces of our animals too hard. And still higher up, my scouts reported the valley to be absolutely impracticable. This seems to be a characteristic feature of all the valleys which go from the northern *Kara-korum Range* to the S. W. and join the *Shayok*, and probably they become more and more difficult farther south. To them belongs the *Chang-chenmo* valley, though this is strong enough to break through the whole range. We had to return, and camped at a height of 4,995 m.

The next day we returned down the valley and camped at a place where some grass was found. *Camp CCLXXXV* had a height of 4,880 m. The minimum temperature had been  $-34.8^{\circ}$ . At this camp, we let the animals have one day's rest. The next night the sky was cloudy, and the minimum temperature only  $-17.2^{\circ}$ .

On *December 23rd*, we returned to *Burtse* and continued up the main valley to *Kisil-unkur*. *Camp CCLXXXVI*, where the height is 5,128 m., or 320 m. above *Burtse*. The distance from the latter place is 14.4 km., and the rise, therefore, as 1:45. The day was cloudy and a strong wind was blowing, though it is difficult to tell from where in these narrow valleys.

Our direction is N. N. W. The valley is full of gravel and some snow; ice appears only higher up. The mountains at the sides are wild and rocky. A small glacier is seen at the right side of the valley; another had already been passed on the left side, south of *Burtse*. The talus of débris at both sides is steep. The valley makes a sharp bend to the east. Beyond it the wind grew to a storm and came from the south. The snow-patches in the valley are hidden and covered with fine red dust; only higher up the slopes, the snow is white and clear. Clouds of dust and dry snow are whirling up the valley. The country is absolutely barren, since *Camp CCLXXXV* we had seen no grass. Several side valleys open both from the left and right. Two of them are considerable. The main valley finally becomes as narrow as a gorge, between hills of loose material, and in the bed, there is ice. My Ladakis asserted that here somewhere was the place which is called *Daulet Bek-öldi* after a well-known historical event. The name of the place where we camped in this narrow valley was called *Kisil-unkur*.

On *December 24th*, our march continues N. E. for 15.4 km. From *Kisil-unkur* the direction is north and the distance to the *Dapsang Pass* of the northern *Kara-korum Range* is 4 km. The ascent on this stretch is from 5,128 m. to 5,428 m. or 300 m., being at a rate of 1:13.3. On the other, or *Chang-tang* side, we have 11 km. to *Camp CCLXXXVII*, where the height is 5,227 m. or a fall of 201 m., being a rate of 1:54.7. The slope up to the pass from the regions having an

outlet to the ocean, is, therefore, more than four times as steep as the slope from the Tibetan plateau-land without an outlet to the ocean.

From *Kisil-unkur* the road is comparatively easy on the slopes of the right side hills of the uppermost part of the valley. They consist of soft red material. There are the tracks of many caravans to and from *Eastern Turkestan*, and there are, as hitherto, the carcasses of many dead ponies. From the height of the pass, which my Ladakis called *Dapsang*, a name also given to the country to the N. E. of it, it is difficult to get a clear conception of the general orographical features. In the clear and fine weather, we had, however, a magnificent view of the great *Kara-korum* giants to the west and S. W. To the N. E. the country seemed to be most easy for marching. To the east and S. E. there is a labyrinth of red wild mountains of moderate size. We had nothing else to do than continue to the N. E. by the slowly falling erosion valley which, in this direction, goes down from the *Dapsang Pass*, and which seemed to come to an end in a small self-contained basin between the areas of the *Shayok* and *Kara-kash*. Between our valley and the valley of the uppermost feeder of the *Shayok*, we have a range running N. E.—S. W. and parallel to the range in which the *Kara-korum Pass* is situated. These ranges are only of secondary importance and constitute rather superficial features of the great northern *Kara-korum Range* which runs N. W.—S. E. and even S. S. E. The water-parting crest of this range is very irregular and runs in the most capricious, zigzagging windings. The *Dapsang Pass* belongs to this crest, and it is therefore, a water-parting of first class importance. Such is also the case with the *Kara-korum Pass*. A third pass of the same rank, is the *Chang-lung-yogma* which I had crossed in 1906. From north to south the absolute altitudes of these passes are, according to my observations: the *Kara-korum Pass* 5,658 m., the *Dapsang* 5,428 m., and the *Chang-lung-yogma* 5,780 m.

As seen from the *Dapsang Pass*, the whole country was now covered by snow, only the more exposed hills, peaks and ridges being swept free. In all valleys, depressions and erosion furrows, the snow lay deep, one meter and more on our route, and on the surface it had been arranged like dunes of sand. The valley down from the pass which at first sight had seemed to be so easy and comfortable, therefore, proved to be very difficult and tiring for loaded animals. Sometimes we had to follow the crests and slopes of small hills. At some places where the snow was deep, its surface was hard enough to bear the ponies and mules, but, as a rule, they broke through the crust. Having proceeded along the crest, we finally went down into the valley where, on the right terrace of its bed, the snow had been swept away to a breadth of 1 or 2 meters. It was easier to follow all the windings and bends on the edge of the terrace than to march in the furrow, where the snow was treacherous. By and by our valley becomes broader and finally opens out into

a latitudinal valley, at the beginning of which a low red mountain is seen. At its base grew some hard *yapchan* plants which could be used as fuel. Already at 9 o'clock p. m., the temperature was at  $-27.1^{\circ}$ . In the night it went down to  $-38.6^{\circ}$ , very near the freezing point of mercury. From *Camp CCLXXVII*, Pan. 374A and B, Tab. 66, was taken from E. N. E. to W. S. W., the rest of the circle being hidden by the little red mountain. It shows a very irregular morphology, a mountainous country where the denudation and the destructive activity has gone very far.

Already the first day's march in the latitudinal valley, proved that we were on the plateau-land of *Chang-tang* with its even ground and insignificant gradients. *Camp CCLXXVIII*, on *December 25th*, was at 5,208 m. or only 19 m. below the previous camp. The distance being 12 km., the fall was, therefore, at a rate of 1:632, perfectly imperceptible to the eye.

Our march goes E. N. E. between comparatively low, irregular hills of a red colour. The ground consists of yellowish red dust sometimes uneven and furrowed with small watercourses, here and there with ice. Large parts of the valley are covered with snow, which becomes thinner the farther eastwards we proceed. Only in beds it still has a depth of two feet. The northern range is somewhat higher than the southern; only on slopes looking north, there is snow. In the northern part of the valley was a large sheet of ice formed by a spring with running water. Eastwards from this place, the valley becomes narrower and the snow is again deep on its floor. On the lower slope of the northern mountains, which were free from snow and were overgrown with abundant *yapchan* plants, we stopped for the night. From *Camp CCLXXVIII*, an incomplete panorama, 377, Tab. 66, was drawn, showing to the W. S. W. the road up to *Dapsang*, and to the S. E. and E. S. E., irregular peaks and ridges. Unfortunately the southern quadrant of this panorama is missing, including the N. E. side of the *Kara-korum Range*. Pan. 379, Tab. 66, taken from *Camp CCLXXV*, gives an idea of the appearance of the same range from its S. W. side.

On *December 26th*, our march continues eastwards through the latitudinal valley for 18.6 km. to *Camp CCLXXXIX*, rising to 5,383 m. or 175 m. above the previous camp, which gives a rate of 1:106. The minimum temperature was  $-31.7^{\circ}$ , and the sky was covered with clouds. In the morning the wind came from the east, but turned at noon, over south to S. W. The march was very monotonous. Ascending to the east, the valley becomes narrower and is, as a rule, 1 km. broad. The ground is very even and comfortable. Here and there watercourses, filled with snow, are crossed. The valley is straight and regular, bounded on both sides by black mountains of no great height and with patches of snow. Through the openings of two or three side valleys from the south, higher ridges and peaks are visible, completely covered with snow, but not forming continuous ranges.

The soil is partly gravel, partly yellow earth and dust, which, judging from systems of crevices, is soft and floating in the summer. The footprints of antelopes are deep, showing that the light animals had trodden the ground before it was frozen. Since the day before, we follow a well-marked path which seems to be used by antelopes. Tracks of wolves were also seen. Now there were no animals at all. In the western part of the day's march, there was ice in the chief erosion bed of the valley which had well-developed terraces. The latter became lower towards the east and finally disappeared. About halfway, a tributary enters from the south, of nearly the same size as our valley. The plants became rarer and finally ceased altogether. At *Camp CCLXXXIX*, the valley was perfectly barren. To the east the view is open far away and the farthest mountains in that direction do not seem to be snow-covered. According to the general maps of Tibet at my disposal and my own survey of 1906, we should have about 68 miles to *Camp VIII* of the previous crossing, at which I aimed and where grass was to be found, which was necessary, as the animals would die of starvation if the country remained barren. In fact, this distance proved to be 74 miles. The living rock at the camp was dark greyish brown limestone. Dense pink limestone had also been found at *Camp CCLXXXV*.

On *December 27th*, we continued E. N. E., for 4.8 km. falling only 4 m., as *Camp CCXC* had a height of 5,379 m. The rate was here 1:1200 or nearly level. The clouds were impenetrable and the minimum temperature of the night, therefore, only  $-19.1^{\circ}$ . The upper parts of the surrounding mountains were hidden by mist. In spite of this weather, no snow fell. The snow-patches on the ground became more and more rare and thin, and their surface was, as a rule, dirty or yellow from wind-driven dust. The valley again becomes broader. From the south, a large tributary valley joins it. Along the base of the northern mountains, there is a bed with ice. The latter sometimes is convex or cupola-shaped, probably from the pressure of spring-water from below. Grass on the slopes of the northern hills caused us to camp early. In the erosion terrace at their base, the rock was dark grey sandstone. The wind had begun from the east, and then turned around to south and finally S. W. and remained so the whole day. Here the first yak dung was found.

On *December 28th*, we made 13.4 km. E. S. E., descending 80 m. to *Camp CCXCI*, where the height was 5,299 m.; the rate is thus as 1:168. The minimum temperature was only  $-17.4^{\circ}$  and the clouds very heavy, but it snowed only a few minutes and very lightly. A very strong west wind blew from noon until evening. In this part of the valley, snow was seen only in ravines and beds and on slopes falling to the north.

Just E. S. E. of the camp, we cross a ridge of very low hills, 5,346 m. high, south of which there was a sheet of ice, from the eastern end of which an unusually

voluminous brook, containing at least 1 cub. m. of water per second, with a temperature of  $+0.9^{\circ}$  flowed eastwards, and fell into an oblong lake filling nearly the whole breadth of the valley. It was frozen all over, but the brook continued some distance along the ice. It is indeed rare, in these dry regions, to find so much water in a single spring. Our route follows the southern shore of the »lake«, sticking to the lower part of the screes of gravel and talus at the base of the southern mountains, which are rather low, of a red colour and with a good deal of snow. As may be seen through the openings of the southern tributaries, there is, south of this range, another that is higher and has, so far as can be judged in the mist, even some small glaciers. The mountains at the northern side of the valley are higher. On rounded hills at the sides of its flat tributary valleys, there is grass. In the N. W. part of the »lake«, there is a rocky island. The ice-lake became more and more narrow to the east, and at places had a breadth of only 50 or 100 m. Stripes of gravel were seen here and there in the ice, and it became clear enough that what we had called a lake was simply sheets of ice formed during the early part of the winter, and then increasing more and more as the abundant spring was flowing uninterruptedly.

On *December 29th*, the march goes eastwards for 12.8 km. and the ground falls 53 m., as *Camp CCXCII* is at 5,246 m.; the slope is, therefore, very gradual or as 1:241. The minimum temperature was  $-29.9^{\circ}$ . The night had been clear, the morning and day were cloudy. In the morning the wind came from east and south, afterwards steadily from the west. The ice-sheet dwindles and ceases. From the south a large tributary valley opens out. Here the grass is very good. Now, occasionally, yak dung is seen, though rather rarely. A spring again comes up at the right or southern side of the valley. It has only  $\frac{1}{4}$  cub. m. per second but is quite sufficient to give rise to another lake-like ice-sheet in the valley, hardly 4 km. in length. Between it and the foot of the southern mountains, which send their steep slopes down to the edge of the ice, there is very little room for our passage among sharp-edged gravel. It is obvious that these ice-sheets, which indeed give the impression of frozen lakes, are only temporary phenomena of the cold season and nothing but frozen spring-water that increase during the whole winter, and, in the spring, dwindle and slowly disappear. In the summer, there must be an uninterrupted brook flowing down to the valley of *Camp CCXCIII*.

At the eastern end of the last ice-sheet, we cross the glass-clear ice of the brook and camp at a place where the grass is good and where the *yapchan* plants are abundant, affording the best of fuel. Pan. 380, Tab. 66, is a view of the valley looking eastwards from *Camp CCXCII*. The rock is greyish black dense schist, which was attainable *in situ* at *Camp CCXCI*.

On *December 30th*, our march continues down the valley 8.8 km. E. S. E. to *Camp CCXCIII* where the altitude is 5,140 m. or 106 m. below the previous camp,

giving the rate of fall of 1:83, or more noticeable than hitherto. The minimum temperature was only  $-17.8^{\circ}$ , and the temperature at 1 o'clock p. m.  $-14.4^{\circ}$ . It is curious that the difference of the night-temperatures in a few days could be over  $20^{\circ}$ , and that the difference between day and night could be only  $3.4^{\circ}$ . But we were in a period in which the sky is hidden by impenetrable clouds, so much so that even the days were dark. Still, only seldom, a few snowflakes fell, not sufficient to make the ground white.

We cross the ice ribbon at the camp and return to the southern or right side of the valley, where at some places the screes have been cut off, and small patches of grass are seen. On the steep rocks at the left side, a herd of 22 *Ovis ammon* were seen; the first wild animals we had met for a long time. Dung of wild yak is now more common, proving that the animals visit these regions during the summer. *Pantholops* antelopes and kyangs also come to these high mountains, as could be seen from their dung.

The valley that has been narrow a while, again broadens out, and finally joins an extensive, nearly meridional, valley, formed, as it seems, by two valleys, the larger from S. S. W., the other being a right tributary from the S. E. The valley is filled with ice from one side to the other. At the left side, where running water was to be had, we pitched *Camp CCXCIII*. In the corner where both valleys meet, the living rock was dark grey quartzitic sandstone.

The valley coming from S. S. W. or from the north-eastern slopes of the *Kara-korum Range*, and then continuing north, breaking through the mighty ranges of the *Kwen-lun*, is the *Kara-kash-daria*, belonging to the drainage area of the *Tarim* and *Lop-nor*. To give my scouts an opportunity to reconnoitre the way down the river and up through the S. E. valley, we passed a day at this camp, from which the small sketches, Pan. 375, 376 and 378, Tab. 66, are taken, giving aspects of the two above-mentioned valleys from the S. S. W. and S. E., and of the joint valley going north and N. N. E.

On *December 31st*, I sent reconnoitering parties up the valley from the S. E. and down the joint valley to the N. E. At their return, both reported that easy passages had been found eastwards. Therefore, on *January 1st*, 1908, we marched up in the south-eastern direction which was supposed to be the shortest way. The distance to *Camp CCXCIV* was 10 km. We followed the right side of the ice-sheet. At some places the hills and screes fall steeply down to the ice, and force us to march on the ice itself. After a few kilometers, there is an interval between the base of the screes and the edge of the ice and we enter upon more even ground in the mouth of the valley from the S. E. From the point where we leave the principal branch of the *Kara-kash* River, we see its valley continuing S. S. W. in the direction of the principal range of the northern *Kara-korum*, from where the

different source branches of the river are fed. Its bed is completely filled with ice from side to side, so far as the eye reaches, and the narrow valley is bounded by very steep rocks and slopes. In its background, snow-mountains are visible, not very high.

The right tributary which we follow, has ice only here and there in its upper reaches. The valley is regular and hardly 1 km. broad the whole way. There is not much gravel and a good deal of grass, partly the common variety, partly the fine, low, dense, alpine grass resembling soft carpets and which is especially esteemed by the yaks. The ground is, therefore, very comfortable, and the rise, moderate. Dung of wild yak is abundant, proving that the animals visit these high valleys in summer. The kyang seems to be a more rare guest. There were no signs of other animals; only rabbits' holes.

After a march of 10 km. it became obvious that it was impossible to proceed farther in this direction. The valley came from a ring of snow-covered flat mountains where three short glaciers were seen; the one from the pass seemed to be fed from two fields of *névé*. The view to the S. 30° E., is found on Pan. 382, Tab. 67. From the same place, the point where we turned back, the sketches 381 and 383, Tab. 67, are drawn. We camped in the mouth of a tributary valley from the east. This valley was also blocked in its upper regions by impracticable mountains which appeared to be the northern ramifications from the glacier group just mentioned. A very strong wind was blowing most of the day, though in these closed valleys, it is difficult to tell from which direction it comes.

The height at *Camp CCXCIV* was 5,300 m. On *January 2nd*, we had 13.5 km. down to *Camp CCXCV* at 5,088 m., or 212 m. lower, thus giving a fall of 1:64. The minimum temperature was  $-25.2^{\circ}$  and the sky was clear. Having built a cairn adorned with an old yak's skull, we again marched down the valley. At the point where it joins the *Kara-kash*, were two small sheepfolds about 3 m. in diameter, and probably rather old, for it is not likely that shepherds visit these regions nowadays. *Camp CCXCIII* was passed, and we continued along the right brim of the *Kara-kash* ice. Steep screes of sharp-edged gravel fall down to it. Here and there are small patches with soft ground and some grass. There is a path, though we could not tell whether it had been trodden by men or wild animals. The valley becomes broader, with gravel and sand to the right of the ice. The living rock is dark grey quartzitic sandstone. Finally, the ice-sheet is divided into branches and there is no running water. The valley turns more and more to the right or N. E. and E. N. E. In its background there are moderate mountains, without snow. The erosion bed with its ice keeps to the left side of the valley. *Camp CCXCV* was pitched on soft, sandy ground at a narrow place of the *Kara-kash* valley, where grass, ice and yak dung were abundant. Pan. 384, Tab. 67, is a sketch of the camp with its surroundings.

On *January 3rd*, the march is 16.3 km. in length and the general direction is E. S. E. The minimum temperature was  $-22.4^{\circ}$ , the clouds very heavy and dark, and mist filled the valleys. In the morning some snow fell, making the hills partly white, whilst on the ground of the valley, the snow at once disappeared. For many days we had not seen the sun. It was the same dark, cloudy and foggy weather, as at the same season the previous year.

The valley now becomes broader, being at least 1 km. wide. Following the right bank of the *Kara-kash* to the E. N. E., we soon reached the place where the river turns to the N. N. E. and N. N. W. In the mist it was impossible to get a clear conception of the details of the landscape. Here, a broad tributary valley joins the *Kara-kash*. We followed it S. E. This may be the same way which had been taken by Crosby, though it is difficult to tell on account of the small scale of his map. On the left or southern side of this valley, there are mighty snow-covered black mountains; on the right side are red and yellow hills of no great height. On the slopes, there is some grass. The bed of this valley was completely dry, not even ice was seen, only in protected parts of the bed there was still some snow. Of life, only a raven was seen. During the last part of the march, the ground was barren. At a place where a tributary opened from the south, grass again appeared on the slopes, together with the usual hard plants which are excellent as fuel. No other water than melted snow was to be had. The weather was extraordinary. The mist became impenetrable, and in the afternoon it began to snow. In the evening it snowed in fine, dry flakes and the whole country became white. At the same time, the stars were visible. When the sky was covered with nearly black clouds no snow fell, but when the sky was clear it snowed. The minimum temperature was down at  $-28.8^{\circ}$ . My Ladakis asserted that this place, *Camp CCXCVI*, is called *Yapchan*. Its height is 5,201 m. The next day, which was sacrificed for a rest, the weather was clear and sunny, but a strong west wind blew. Pan. 385A and B, Tab. 67, was sketched. To the E. S. E. and S. E., it shows some very sharp pyramidal peaks. To the S.  $2^{\circ}$  W. is the extensive southern tributary valley. S. W. and west is a group of black wild snow-covered mountains, in our vicinity. To the N.  $60^{\circ}$  W. is the valley by which we have come, which is a right tributary to the *Kara-kash*.

On *January 5th*, we made 12.6 km. nearly eastwards. During the first 10.2 km. we had to ascend from 5,201 m. to a pass of 5,485 m., or 284 m., being a rate of 1:36. From the pass we again descended to *Camp CCXCVII* with a height of 5,260 m. or a difference of 225 m., being an unusually steep slope or as 1:10.7. The minimum temperature was  $-22.7^{\circ}$ . Early in the morning, the snowfall was livelier than before and the whole land became perfectly white.

Eastwards our valley is bounded by wild, rocky, irregular mountains with sharp peaks, pyramids and needles cropping up from the enormous heaps of detritus



surrounding them. There are sharp-edged ridges and crests with steep passes between; never continuous, always interrupted and without any clear orographical order. Near *Camp CCXCVI*, the living rock was reddish brown crystalline limestone, which continued the whole way to and on the pass, and was followed, near *Camp CCXCVII*, by grey mica-sandstone.

We followed the erosion bed of the valley, the bottom of which consisted of fine gravel and very fine red sand. Higher up the ground is barren. From both sides tributary valleys join the main valley, some of them considerable and bounded by high mountains. At one place in the beginning of the march, three stones betrayed an old fireplace, where probably wanderers from *Shahidullah* had camped.

The pass is visible in front of us, and the ascent becomes more steep. The threshold is flat and easy, the barren soil consists of soft fine material. To the S. E., a very wild and irregular yellowish pink range is seen reminding one very much of the range we had seen the year before on the southern shore of *Lake Lighten*. Orographically, it may be the same range, though, of course, it is interrupted for a long way. There is no doubt that ever since *Camp CCLXXXVII*, we had followed one single latitudinal valley of tectonic origin, which is traversed by the erosion valley of the *Kara-kash* at nearly right angles, and which, farther east, is continued in the enormous valley I had followed in 1906, and where the lakes of *Aksai-chin*, *Lake Lighten* and others are situated. Here in its western part this valley is, however, at a greater altitude, is narrower, and has more undulated ground.

From the pass, we have a clear view not of level and easy ground as usual in latitudinal valleys, but of an oblong basin stretching E. S. E., bounded on the south by comparatively mighty and rocky mountains, on the west by the threshold on which we stood, on the east by a new threshold which we crossed the next day, and on the north by a mountain range which is pierced by a valley in which all the watercourses of this basin gather. The joint affluent of the basin is probably a tributary to the *Kara-kash*. The slope down from the pass is steep; we follow the bed of the watercourse which is filled with gravel and has no ice. The nearest hills consist of loose, fine, red material. Where it emerges into the basin there is grass growing on the slopes exposed to the south, and there was snow in the furrow where we camped. No wild animals were to be seen, only some sparse dung of wild yak and kyang. From *Camp CCXCVII*, Pan. 387, Tab. 68, was sketched, showing the wild and rugged mountains to the east and S. E. To the S. 62° E., is the way up to the next pass.

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## CHAPTER XVI.

### LATITUDINAL VALLEYS OF THE CHANG-TANG.

On *January 6th*, our march goes E. S. E. for 16.4 km. The way to the pass is 8.8 km. and the rise 228 m., or as 1:39; from the pass to the next camp the ground falls 340 m. or from 5,488 m. to 5,148 m., a fall of 340 m. and a rate of 1:22.4. This pass had, therefore, nearly the same altitude as the previous one, the difference, according to my instruments, being only 3 m. These figures show that the floor of this part of the extensive latitudinal valley is rather undulated and that it has not yet assumed the great evenness which we had found farther east on the *Chang-tang* proper. On both sides of the pass and at *Camp CCXCVIII*, the rocks consisted of greyish white dense limestone. The minimum temperature was  $-33.4^{\circ}$ . As seemed to be the rule at this season, the day began with eastern wind, which gradually went over to S. W. and continued during the night.

We cross the basin diagonally to the E. S. E., also several beds and dry watercourses, all converging in the direction of the comparatively broad, transverse valley, which pierces the northern moderate hills of comparatively rounded forms. In its background, a smaller snow-covered ridge is seen, belonging to the *Kwen-lun* System, the principal ranges of which are not visible. The sources of the small watercourses are situated at a few kilometers' distance, among the wild southern mountains sketched on the last-mentioned panorama. Farther on, the limestone rocks to our right show extraordinary formations, standing in long rows of nearly perpendicular screens, being broad when looked at from the side, but like needles when seen in a foreshortened perspective. Between these picturesque red and yellowish rocks, we enter the valley coming from the pass. As we proceed, it becomes narrower and steeper. Its floor is gravel; the ground is covered with snow.

From the height of the pass the landscape to the east looked favourable. The valley going down to the E. S. E., opens out into a plain from which there seemed to be easy passages, both to the E. N. E. and S. E. To begin with, the fall is steep and the slopes full of sharp-edged gravel, but lower down, the rate is gradual and the gravel fine. We cross the plain where the ground is perfectly even to the eye.

To the north is a transverse valley, which probably pierces the mountains and perhaps belongs to the *Kara-kash* like the one of the previous day. South of our route was a large sheet of ice. The plain was surrounded by irregular, interrupted and detached mountains. At the base of the eastern hills, *Camp CCXCVIII* was pitched. Here nothing, except the usual hard plants, was to be had. There was not even a sign of snow, the country was quite bare and barren. The last pass had formed a very sharp boundary to the snow-fall. Even the surrounding hills were bare. That the snow-falls of the *Kara-korum* region thus suddenly ceased, looked somewhat critical for us, as we, at several camps, had not had other water than that from melted snow. The animals had to be brought to a place with grass and they got a day's rest at this camp. After a temperature of  $-30.2^{\circ}$  in the night, a regular S. W. storm began to blow at 10.30 o'clock a. m., increasing in the course of the day and bringing dark clouds over the desolate hills. Pan. 386A and B, Tab. 67, shows the extraordinary forms of the mountains, more particularly to the N. N. W., with sharp pinnacles of limestone cropping out of the detritus.

The march of *January 8th*, is directed E. N. E. for 15.8 km. and again has a transverse threshold in the latitudinal valley to be crossed. This threshold is situated halfway between the two camps, 7.9 km. from each. Its height is 5,355 m.; the rise from the 5,148 m. high *Camp CCXCVIII*, is, therefore, 207 m. or as 1:38, and the fall to the 5,165 m. high *Camp CCXCIX*, is 190 m. or as 1:42. The rock at the first-mentioned camp was greyish white dense limestone; on the pass we had reddish brown calcareous sandstone. The temperature of the night was only  $-18.5^{\circ}$ , due to clouds and wind.

Marching E. N. E. over comfortable, slowly rising ground, we left to the north the transverse valley which seems to belong to the *Kara-kash* drainage area, and in the background of which flat hills are seen. Near the pass the ascent becomes a little steeper, but is very easy the whole way. The view from this flat threshold looked promising. The valley going down eastwards is broad and open, and bounded by yellowish pink ridges of insignificant height. In its background, no high mountains were visible, and it seemed likely that this valley would debouch into the great *Aksai-chin* Plain where we had had our *Camp VIII* in 1906. At the sides of the erosion furrow from the pass, the usual hard plants, *yapchan* and *burtse*, were growing, and at *Camp CCXCIX*, some grass, sufficient for a night. There was no water, only a very small patch of snow in the bed. From this camp, Pan. 388A and B, Tab. 68, was taken. It gives an idea of the mountain range north of the camp, and the stretching of the latitudinal valley, west and east.

On *January 9th*, we made only 5.6 km. first S. E. and then N. E. In this distance, we descended from 5,165 m. to 4,977 m. or 188 m., giving a rate of the fall as 1:30. A minimum temperature of  $-18.8^{\circ}$ , and thick clouds. We continued

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VIEW TO THE SOUTH-WEST FROM CAMP 302

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VIEW TO THE SOUTH-EAST FROM CAMP 304

ZEN STAB LT WEST STATION



S. E. down the valley until we reached a threshold of only a few meters height, consisting of reddish dense limestone. The view from this little ridge was most interesting and encouraging. To the east extended the typical plateau-land plain far away, and the mountains in this direction were not high and had rounded forms. Only to the north, snow-covered mountains were visible. To the E. S. E., the plain or rather latitudinal valley, continued to the horizon which disappeared in the haze of the far distance, and to the S. E., I believed I could recognize the promontory at the base of which we had had our *Camp VIII*. Between us and this corner, the great plain expands its surface. Now we had left the drainage area of *Kara-kash* behind us, and to the east and S. E. we had the *Chang-tang* proper. The difficult, accentuated country had been crossed with the loss of only six animals, and the country would now be more even and comfortable than hitherto.

The animal life was still very rare. Only one lonely wild yak had been seen, and near *Camp CCXCIX*, a fox and four *Pantholops* antelopes. But the country is very desolate, the water scarce and the height enormous.

However, from the little threshold we turned more and more N. N. E. with hills to our left and the great plain to our right. Water was now the most important question. After a while we saw in front of us an extensive sheet of ice. A shallow erosion bed was directed towards the ice which seemed to occupy a part of a very large alluvial depression. At the edge of the ice-sheet, a fresh spring of  $+0.6^{\circ}$  came forth, forming a little frozen pool, north of which the big ice-sheet obviously was formed by other springs. *Camp CCC* at a height of 4,977 m., was pitched below the terrace of the watercourse. Some grass and fuel was found in a little valley to the east. Tracks of antelopes and kyangs, but no animals, were seen. A strong S. W. wind was blowing until noon, after which the air became foggy and a few snowflakes fell.

The panorama sketched from *Camp CCC* was less instructive than the view from the little ridge. It is, however, shown on Pan. 389<sup>A</sup> and B, Tab. 68. The mountains to the N. W., north, N. E. and east are readily visible. The distant perspective of the latitudinal valley to the S. E. and E. S. E., is hidden by the very flat convexity of the nearest part of the great plain, above the horizontal line of which, only flat mountains show their cupola-shaped heads. The mountains to the S. W. are hidden by the small hills in the immediate vicinity of the camp.

On *January 10th*, we travelled 24.8 km E. S. E. and S. E., descending 61 m. or to 4,916 m., which was the height at *Camp CCCI*, the rate of fall was 1:407. The minimum temperature was  $-23.1^{\circ}$ ; during the night it snowed, but only the hills were white in the morning. The wind came from the south but early, before noon, it turned to S. W., as usual, and remained so the whole day. We cross the great plain diagonally, and the march is very monotonous. To the naked eye it seems

to be perfectly horizontal, and it would be quite impossible to tell in which direction it slopes. Several small, dry watercourses are crossed, which seem to be directed N. E., though even this cannot be determined. Large surfaces have no signs of erosion at all. The soil is perfectly barren and consists of fine, soft material, sand and sparse, fine gravel. Clouds of dust are driven by the wind to the lee side of the caravan. After a few hours' march, the mountains near *Camp VIII*, were easy to recognize, and we camped quite near the same place, perhaps 1 km. north of it, as soon as the grass on the sandy ground proved to be thick enough. The absolute height will be about the same; at any rate the undulations of the ground are very insignificant.<sup>1</sup> Pan. 391A and B, Tab. 69, gives an idea of the view from this camp, which should be compared with the panorama taken the year before from a point  $1\frac{1}{2}$  km. W. S. W. from *Camp VIII*.

On *January 11th*, we accomplished, for the second time, the march from the good grazing ground of *Camp VIII* and *Camp CCCI* to the Lake *Aksai-chin*, 17.5 km. in length. On this section the ground remains practically at the same level, the altitude of *Camp CCCI* being 4,916 m. and that of *Camp CCCII* 4,914 m. The temperature of the night was  $-23.9^{\circ}$  and the day was cloudy with a strong wind from the east. Of animal life, only three antelopes and one kyang were seen. The day's march was the same as the year before, though we did not follow any track of wild animals, and did not see any footprints or other remains of my first caravan. Two or three white patches, a few kilometers north of our route, could be salt as well as water. But *Camp CCCII* was certainly exactly the same as *Camp IX*, for there the old fireplaces and a heap of dry plants for fuel were still left at the side of the fresh-water spring at which we had camped in 1906. Very good grass was found in the southern hills near the spring, *yapchan* plants being abundant as well as dung of kyang and yak. We stayed here for a day. On the second night the temperature was at  $-18.6^{\circ}$  and it snowed so much that the whole country became white. This day the wind came from the west. The whole Lake *Aksai-chin* was open, its water being extremely salt.

From *Camp CCCII*, Pan. 390A and B, Tab. 68 was taken. It should be compared with Pan. 24A and B, Tab. 5, taken from the same point on September 6th, 1906. The small differences in details depend chiefly on the fact that the panorama of 1906 was made in the afternoon of a sunny day and that of 1908 on a cloudy day when the whole country was covered with snow. In Vol. III, opposite p. 316, is a coloured view to the N. N. W. from *Camp CCCII*, as it was before the snowfall had begun.

<sup>1</sup> In my personal narrative, the height is given as 4,937 m.; 4,916 m. is the mean altitude from the observations of both 1906 and 1908. The same is the case with *Camp CCCII*, where 4,929 was the result of the observation of 1906 only, and 4,914 m. of both years' observations.

On *January 13th*, we moved 22.3 km. E. S. E., rising only 21 m. or to 4,935 m. at *Camp CCCIII*, being a rate of 1:1062. The temperature of the night was  $-28.0^{\circ}$ . In the morning we had a west wind. It had snowed in the night, but only on the northern hills, where no bare patches were left. About 9.30 o'clock a. m. it began to snow again for half an hour. At the same time a very thick fog came up from the east, concealing all the surrounding mountains. Even the eastern end of the lake became hidden. We now left our course of 1906, and proceeded along the base of the southern mountains, crossing a broad, shallow and barren erosion bed from a larger transverse valley to the south. The good grass had ceased about one hour from the camp; to judge from the enormous amount of dung of wild yak and kyang, it was a well-known grazing-ground for these animals. Then only *yapchan* plants were abundant the whole way to the next camp. The soil consists of soft sand and dust; gravel is only passed in erosion furrows. A herd of antelopes fled at our approach; no other animals were seen except two ravens.

The west wind begins again, and the fog is swept away. In front of us, is a little threshold between the southern hills and a detached hill which we had left to our right in 1906. To our left, is the broad and open latitudinal valley with half its area white with snow, and its principal watercourse, to which broad erosion beds go down from the southern valleys. Some of them have terraces, 1 m. high, at the east or lee side of which, a good deal of snow has been swept by the strong west wind. *Camp CCCIII* was pitched in the mouth of a southern valley, where grass and fuel were abundant and the snow afforded water. Pan. 392A and B, Tab. 69, is taken from this place.

On *January 14th*, our march goes E. S. E. and S. E. for 17.7 km. rising 10 m., as *Camp CCCIV* is at 4,945 m. which means a rise of the ground at a rate of 1:1770 or a practically level country. The temperature went down to  $-36.1^{\circ}$ . We crossed the little threshold just east of the camp, being only some 30 m. high above the surrounding ground. From here the great latitudinal valley of 1906 is seen stretching far away to the east. Our passage to the S. E. seemed to be obstructed by moderate mountains, but soon we found an opening between two hills, and a large even plain stretching S.  $55^{\circ}$  E., being in connection with the extensive latitudinal valley. In this direction, all vegetation gradually disappears. The soil is fine, grey clay, or dark brownish dust, the latter being soft and tiring for the caravan animals. In the lowest part of the plain, where the height of 4,928 m. was read, running water had modelled the clay deposits into terraces, platforms and tables. Several shallow erosion beds convey into this flat depression, probably the basin of a dried-up lake. Calcified parts of plants form a fine gravel, as it were, on the surface of the soil. To our right are hills of moderate size, all white with snow. In the S. E. part of the plain, the soil consists of reddish brown and very



soft sand with some fine gravel, and here we cross two or three erosion beds from the southern and S. E. valleys. A little farther on, we enter the valley coming from S. E. Just at its mouth, there is good grass at the base of the hills to the right, together with *yapchan* and snow. And here *Camp CCCIV* was pitched. The panorama that unfolded itself from this place is seen on 394A and B, Tab. 69. To the S.  $58^{\circ}$  E. is the pass, from which this valley begins and which we had to traverse. To the N. W. and N. N. W., are some of the mountains at the north side of the large latitudinal valley.

On *January 15th*, the road continues for 11.0 km. between E. S. E. and S. E., up the valley, the ground rising 113 m. or at a rate of 1:98, as *Camp CCCV* has a height of 5,058 m. After a temperature of  $-39.8^{\circ}$  in the night, the sky was clear and blue, and there was no wind in the morning. We follow the broad, open valley, the soil of which still consists of soft, reddish brown sand and very fine gravel. The mountains at both sides are rather low. About half the ground is snow-covered, in deeper furrows the snow is sometimes two feet deep. *Yapchan* grows the whole way, grass is sparse. To our right, a picturesque snow-group becomes more and more hidden as we proceed. We camped at the right terrace of the principal watercourse of the valley, as the grass was not bad and snow plentiful. The surrounding mountains are seen on Pan. 395A and B, Tab. 70 with the pass to the S. E. Thrice in the course of the day, antelopes had been seen; no other animals, but numerous tracks.

On *January 16th*, our march goes 10.3 km. E. S. E. The first 4.2 km. lead us to the pass, the altitude of which is 5,161 m., being a rise of 103 m. and a rate of 1:41. From the pass to *Camp CCCVI* at 5,095 m., we have 6 km. and a descent of 66 m., at a rate of 1:91. The minimum temperature was  $-34.4^{\circ}$ ; the day clear and without wind. The severe cold and calm weather accompany each other. The features of the valley are the same as the day before. It is broad with irregular mountains of moderate height and a reddish colour on the sides, the soil is soft sand and fine gravel; sometimes there is grass in patches, most of the ground is snow-covered, and in ravines and furrows, it may be one or two feet deep. The pass is flat and open. To the south and S. W. there is a plain or depression bounded, on the west, by mountains, and with a small lake in our neighbourhood. To the S. E., the slope is comparatively steep to begin with, but soon the ground of the valley we now follow to the east, seems to rise very slowly in the direction of our march; probably this valley drains to the little lake we left to our right. The soil is soft sand with patches of good grass. To our right is the picturesque snow-group we had seen before, now quite near to our route. To the east, the valley is comfortable for a long way. To the south it would have been difficult to proceed, as we had here the continuous range to which the high snow-group

PL. IV

S 34° E

S 28° W



A. MOUNTAIN GEOLITE NEAR CAMP 306

N 46° E



CLIFF 306 - 45° 57' 57" E

CAMP 306



belonged. We camped at the northern side of the valley at the base of red hills of reddish, white, dense, weathered limestone. The grass was good. Water was obtained from the snow and from the ice of a spring. *Pantholops* and one *Ovis ammon* were seen. During a day's rest at *Camp CCCVI* and after a temperature of  $-26.6^{\circ}$  in the night, the wind blew from the S. W., though not very hard.

On *January 18th*, we made 12 km. to the east. *Camp CCCVII*, at 5,110 m., was only 15 m. above the previous camp, being a rate of 1:800. The minimum temperature of the night was  $-24.8^{\circ}$ . The latitudinal valley we now are following, is broad and flat and parallel to the valley of 1906, all mountain ranges stretching east and west, or nearly so. During the first few kilometers the ground rises very slowly to a flat, hardly noticeable threshold which is a water-parting of the valley. Beyond it the shallow, broad erosion furrows are directed to the east. From the southern mountains, a series of watercourses come down to the principal erosion furrow of the valley, and we have to cross them all. Their left terraces are 1 or 2 m. high and rounded. At their lee side, snow is accumulated. Otherwise there are only small snow-patches here and there, as for instance at the lee side of every *yapchan* plant. The northern mountains are interrupted, rocky, rugged and steep. In the opening between two of these hills, one gets a glimpse of the extensive northern valley. To the N.  $31^{\circ}$  E., there is a considerable peak at a distance of some 50 km., and beyond it another snow-mountain. These mountains are situated to the north of my route of 1906. The principal erosion furrow is to our left. On our right, is still the range which we have to cross to be able to reach *Arport-tso*, which now was my nearest goal. Our valley falls slowly eastwards, and seems finally to open out into an extensive plain which, to the north, may also be in connection with the latitudinal valley of 1906. Beyond a rocky promontory of the northern hills, the view to the N.  $67^{\circ}$  E., is unusually extensive. In the background, snow-covered mountains are visible which may belong to the range on the southern shore of *Lake Lighten*. In the nearer prolongation of one valley, there is a little lake, which seems to be open and, therefore, must be salt. One gets the impression of enormous plains on which the mountains are arranged like more or less interrupted protuberances, chiefly stretching east and west. Proceeding on the slopes of the southern mountains, we finally entered a valley from the S. E., where, on the slopes of the right side, the grass was good, fuel and snow abundant. Here is *Camp CCCVII*. Only a few *Pantholops* antelopes and the fresh track of a yak were seen. Pan. 396A and B, Tab. 70, was sketched from this camp. It shows a considerable snow-mountain to the S.  $50^{\circ}$  E., and in the same direction, as well as south, S. W. and west, the range we had had to the south. To the N. N. W. is a curious red ridge with an enormous talus of detritus at its base, and beyond it, nearly north, snow-

covered ranges are seen at a great distance. This picturesque landscape was sketched in water colours.

On *January 19th*, our route is E. S. E. for 12.5 km., rising from 5,110 m. to 5,305 m. at *Camp CCCVIII*, or 195 m., being a rate of 1:64. The minimum temperature was  $-23.9^{\circ}$  in spite of the sky being quite clear, but the usual S. W. wind was blowing. The valley is narrow, as a rule only 100 m. broad, and winding a little; at one place the breadth is only 10 m. between hard, horizontally stratified, terraces. Its bottom is full of gravel. Higher up, ice appears and finally forms a continuous ribbon in the bed of the erosion furrow. Sometimes we proceed on the soft slopes of the mighty southern mountains. We follow a path probably trodden by wild animals. Grass and *yapchan* is seen nearly everywhere, and dung of wild yak is abundant. The narrow valley finally opens out into a round plain, draining to the valley we have followed, and surrounded everywhere by mountains. Only to the south, there seems to be a rather flat threshold, beyond which new ranges are seen. We stick to the slopes of the northern mountains, traversed by many erosion furrows and having vegetation everywhere. The principal watercourse, containing some ice, is to the south, slowly turning north in search of its exit to the latitudinal valley. Continuing eastwards we crossed a very flat threshold, east of which were high difficult mountains, partly with eternal snow and rudimentary glaciers. We, therefore, decided to turn south the next day, where the country was easier. In the meantime, *Camp CCCVIII* was pitched just east of the pass, perhaps 10 m. below the crest. A strong S. W. wind was blowing. Everything necessary was abundant in the region. In the evening we had a severe storm for half an hour. In the middle of the narrow valley, the living rock consisted of red conglomerate, and in the upper part of the same valley, of grey dense limestone. The view around this camp is shown on Pan. 397A and B, Tab. 70. To the S. W. and W. S. W. are the irregular peaks of the range, bordering the little plain to the west. N. W., north, and N. N. E. is the hill in the vicinity of the pass and the camp. To the N. E. and east are irregular ridges and peaks and N.  $66^{\circ}$  E., a snow-covered group. E. S. E. and S. E. is a large accentuated group, cut through by transverse valleys in all directions. To the S. S. W. is the open country by which we continued the next day.

After a horrible night with a S. W. storm and a temperature of  $-24.6^{\circ}$ , we continued, on *January 20th*, nearly south, a little towards the west, for 12.3 km. As *Camp CCCIX* has a height of 5,242 m., the fall is 63 m., or at a rate of 1:195. On the way a point with a height of 5,324 m. is passed. From *Camp CCCVIII* or its neighbourhood, Wellby and Malcolm seem to have passed N. N. E. They came from S. S. W. about the same way as I now travelled, but in the opposite direction. We travelled on the western slopes of the snow-mountains east of our

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N 30° W

N 11° W

N 1° W



LOOKING N N W FROM CAMP 307



THE LITTLE SALT LAKE SOUTH OF CAMP 309



route, crossing a series of dry watercourses all going down to the plain and to the narrow valley directed to the N. W. The largest of them comes from E. S. E. and is rather deep-cut. It is impossible to tell in what direction the ground falls. Still somewhere a very flat threshold is crossed, for farther south, the watercourses go S. W. The soil is sand and fine gravel with some of the common plants and very scanty grass. Having passed a promontory on our right, a new latitudinal valley becomes visible, and in it, to the S. S. W., is a lake which seems to be small and round, and is frozen only along its shores. This may be the *Tsaga-tso* or *Sumtsi-tso*, along which have travelled Dutreuil de Rhins in 1892, Bower in 1891—92, Wellby in 1896, Deasy in 1896, Rawling in 1903 and Zugmayer in 1906. It seems also to be identical with the one along the eastern shore of which Carey travelled in 1886. According to the map in 1:1000000 constructed and drawn by Colonel Byström and accompanying this work, the routes of all the mentioned explorers form a network on the shores of this lake, and between it and the *Arport-tso*. To me it was important to leave this comparatively well-known country as soon as possible. However, my goal was the central parts of *Transhimalaya*, and I had to accomplish this long roundabout way from the north, to escape the attention of the Tibetans. From our camp, only a part of the lake was visible, as shown on Pan. 398, Tab. 71, where we have it to the south and S. S. W. The same landscape is represented in water colour on one of the accompanying plates. The living rock was yellowish sandstone near the flat threshold, dark red weathered limestone just north of *Camp CCCIX*, and light grey dense limestone at the same camp. The water of the lake proved to be very salt and had a temperature of  $-1.4^{\circ}$  at noon.

In a valley from the east and joining other watercourses around the camp, the grass was good, and fuel plentiful. The snow gave us the necessary supply of water. Since *Camp CCCII*, we had not come across any running water. It is, therefore, necessary to have a rest every fourth day as it takes a long time to melt a sufficient amount of snow for the 28 caravan animals which remained since 12 had fallen. During the three marching days, the ponies and mules must satisfy themselves with eating snow. On the 21st of January, a strong S. W. wind was blowing after a night of  $-23.3^{\circ}$ .

On January 22nd, we travelled 12 km. E. S. E. The altitude remained about the same, as *Camp CCCIX* had a height of 5,242 m. and *Camp CCCX* 5,244 m. At a point on the road, the instruments gave 5,250 m. The minimum temperature was  $-23.4^{\circ}$ . Going down a bit along the watercourse of the camp, and crossing other watercourses joining it, we now came in sight of the whole lake which had the most brilliant blue colour and was surrounded by barren, desolate shores. It is now obvious that the lake is oblong from east to west, and occupies the midst



of the latitudinal valley, which we follow to the E. S. E. In the western part of this valley, small snow-covered mountains are seen, though it is impossible to tell whether they rise at the end of the valley or only indicate a change in its direction. To the left of our route, we have low hills. To the south, the latitudinal valley is bounded by a range of moderate height and with much snow. To the S. E., is a pyramidal peak covered with snow and of considerable height. In the valley, there are *yapchan* plants in large quantities. The amount of snow decreases to the east, and patches remain on the ground only at the lee sides of ravines and terraces. Several times *Pantholops* antelopes were seen, two and two or 4 or 5 together. Of wild yak and kyang, only the dung was seen.

Turning E. S. E., we have a distant view of the continuation of the latitudinal valley. *Camp CCCIX* may be some 40 m. above the lake. To begin with, we descend about 25 m. after which the latitudinal valley rises slowly in the direction of our course. Far to the E. S. E., mountains are seen. Still all watercourses are destined to the lake. They are very shallow. South and S. S. W. of the lake, there was an interruption between the mountains, obviously the valley that had been used by some travellers. On the northern slopes of the latitudinal valley as well as on its flat floor, grass is seen in patches. From the little flat threshold of 5,250 m., a small frozen lake comes into sight, surrounded by a 8 m. high beach, at the eastern or lee side of which snow lay accumulated to a considerable depth. Following the S. W. shore of the lake, we found more recent beach-lines, the result of a constant desiccation. The ice-sheet sloped down from the shore as if the lake had sunk 1 m. since the freezing began. At the southern shore, there was a hole in the ice formed by springs. The water proved to be perfectly fresh and clear. As the grass was good, we stayed over the next day at the southern shore of this lake. To the north were mountains of moderate size, to the east the country seemed to be favourable for the march. Just after noon, the wind increased to nearly a storm. The minimum temperature had been at  $-18.4^{\circ}$ . From 7 to 8 o'clock in the evening, it snowed.

On the night of *January 24th*, it snowed again and the temperature was at  $-28.0^{\circ}$ . The whole landscape was again quite white. From 10.30 o'clock a. m., a strong S. W. storm was blowing. Our march went on to the east for 15.4 km. From 5,244 m. at *Camp CCCX*, the ground ascended to a little pass of 5,291 m. Here the distance is 4.6 km. and the rise 47 m., at a rate of 1:98. *Camp CCCXI* was at 5,296 m., or 5 m. higher than the threshold, the rate being here 1:2160. We follow the shore of the lake with the greyish green slopes of terraces to our right, pierced here and there by ravines. Among them is a small valley from the south. The largest affluent of the lake is the principal watercourse of the latitudinal valley coming from the east. Turning east, we soon reach the little threshold from which



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the view in this direction extends very far. In the background, considerable mountains rise above the horizon, but at two places, comparatively low passes seem to be situated. For about two days, we would apparently have comfortable ground to cover. The latitudinal valley is here as broad and open as a plain, stretching E. S. E. Grass is seen at several places, both along the soft slopes of the rounded hills to the north, and, here and there, on the floor of the valley, where some flocks of antelopes were seen grazing. On the snow-covered ground, the animals are easier to see than usually. From the little threshold, the ground slowly slopes downward for about 40 m., after which it again rises to the camp. To our left is seen the principal watercourse of the valley between its terraces, obviously going in the direction to the fresh-water lake. To the eye the whole plain seems to be perfectly horizontal. To the south it is bounded by a considerable range with a mighty peak with eternal snow, and a more bulky cupola-shaped mass quite covered with snow. S. E. of the latter, a third culminating group of the range is visible. Our route goes north of this range. To the left, we have smaller, interrupted hills. Through an opening between them a yellowish pink, rocky range to the N. E. becomes visible, certainly the one on the southern shore of *Lake Lighten*. Between shallow erosion beds, we finally turn N. E. and camp among good grass. The storm continued with all its fury, sweeping heaps of dry, fine snow along the soil and accumulating it at the lee sides of terraces and unevennesses of the ground. Pan. 400, Tab. 71, shows a comparatively easy passage to S. 60° E., and to the S. E., south and S. W. the range or system of ranges we had had on our right.

On *January 25th*, we continued E. S. E. for 13.1 km. The ground ascended from 5,296 m. to 5,337 m. or 41 m., which is at the rate of 1:320. The minimum temperature was -29.6° and in the morning, the clouds were so impenetrable as to make the whole country half dark. At some places the valley seems to be up to 10 km. broad, or more. It is overgrown with the common plants in great abundance, whilst grass is more sparse and only on the slopes at the northern side. At a greater distance to the east and E. N. E., is a high snow-covered range with several ridges visible in an opening between the northern hills. Through the same opening, we behold in our vicinity, a small oblong lake, the greater part of which is frozen, though at two or three places, open water is also seen. A few watercourses, crossed by our route, are directed to this lake. The ground consists of fine gravel on soft dust, where the tracks of wild animals are very numerous. To the south, our latitudinal valley is still bounded by the high range, the mightiest parts of which seem to have small glaciers. The valley farther on turns E. N. E., and is there the same as the one used by Deasy on his way between *Arport-tso* and *Yeshil-kul* in 1896. As I was bound for *Central Transhimalaya*, I had to abandon this latitudinal valley, the sooner the better. At *Camp CCCXII* where the

grass was good, we were separated from the last little lake only by a ridge of low hills. At several places *Pantholops* antelopes were grazing. From this camp, Pan. 399A and B, Tab. 71, was sketched. Its most interesting part is the considerable range to the south. Two culminating cupola-shaped peaks on it, can also be recognized, though in greater detail, on the water colour plate at the opposite side. The upper one of these, is situated to the S.  $11^{\circ}$  W. from *Camp CCCXII*, the lower one to the S.  $53^{\circ}$  E. The first-mentioned seems to have rudimentary glaciers. A comparison between the two, shows the fact that the amount of snow again began to decrease towards the east.

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## CHAPTER XVII.

### ARPORT-TSO AND SHEMEN-TSO.

On *January 26th*, we continue to the S. E. for 14.6 km. descending 39 m. or to the altitude of *Arport-tso*, which is at 5,298 m.<sup>1</sup>; the rate is, therefore, as 1:374. The minimum temperature was  $-22.2^{\circ}$ . In the night it had snowed and the country was white again. The clouds were very dense and the S. W. wind increased in force in the course of the day. Comparing our experiences from the previous year, we had found that the W. S. W. and S. W. wind is a very characteristic feature of the winter in Tibet, and that calm days are exceptionally rare. Cloudy days are numerous, and it snows sometimes, though seldom much. To us the snow was a blessing, without which we would have had difficulties with the water question. It is hard work to make a map of a country at a temperature of  $-15.5^{\circ}$  and a strong wind. The shortcomings of my winter maps will be understood if we remember the great difficulties under which they have been made.

We cross the latitudinal valley diagonally. The soil consists of reddish brown, fine gravel and sand. The *yapchan* plants are abundant everywhere and there are rabbits' holes by the millions. It would be impossible to tell in which direction the ground slopes, if we did not soon behold the surface of a very irregular lake which was recognized as the *Arport-tso*. Some shallow watercourses go down to its shore. We direct our course between the western shore and a red promontory standing there. The whole lake is frozen over and covered with snow, which is driven in clouds across the crystal-clear ice. To the S. E. there is a bay or inlet of the lake, on both sides of which capes and promontories fall, sometimes rather steeply, to the shore. In the prolongation of this bay, the yellow colour betrays the existence of grass on the plain which extends to the foot of the southern mountains. The latter seem to be ramifications from the high range sketched the day before, or, at any rate, to be in connection with its eastern continuation. On the eastern shore, some dark rocks form small peninsulas. The lake was oblong from north to south, and

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<sup>1</sup> According to Rawling its height is 5,335 m.



as our route struck it at the middle of its western shore, it was a question of whether we should march north or south of it. Having passed the eastern-most promontory of the hills on the west shore, we found that the lake continued in a large basin to the south, and that we had marched on a flat, sandy, barren peninsula, ending with a sharp point to the south. In front of us was then the narrowest part of the lake, and opposite us a more considerable rocky peninsula. We crossed the snow-covered ice in the course of half an hour, and then followed the N. E. shore of the peninsula, which proved to be extremely difficult marching as the rocks fell perpendicularly down to the lake and forced us to go on the ice, long stretches of which were swept free from snow. In the strong wind, we had endless trouble in getting the mules across the ice. Between different promontories, were small bays with sandy ground, which were of assistance to us. But when finally the water along the shore was kept open by springs, we had to climb up and down across the hills. At a larger bay with a 2 m. high sand wall along the shore, inside of which grass and fuel were to be had, we made our *Camp CCCXIII*. From this point, Pan. 401, Tab. 71, was drawn, only a little more than one quadrant being visible from our bay, or the mountains surrounding the northern basin of the lake. From *Camp CCCXII* to the northern point of the peninsula, the living rock was a dark grey dense limestone, and at *Camp CCCXIII*, grey and reddish limestone.

On *January 27th*, we marched not quite 2 km. S. E., with the single intention of reaching the good grazing-ground at the southern shore of the bay. In this short distance, we had partly to walk on the ice and to cross a flat ramification from the hills. The rock was limestone as before. *Camp CCCXIV* which had, like *Camp CCCXIII*, practically the same height as the lake or 5,298 m., was pitched inside a sand wall, of the same appearance as the one at the previous camp, and mixed with the remains of dead water plants. The ice of the lake was here 30 cm. thick. According to my men the water of *Arport-tso* was slightly brackish, though to my taste it was as nearly fresh as possible and could very well be drunk. Our animals drank it without hesitation. As several springs came up along this shore, it may be that they account for the comparatively good taste, and that the water of *Arport-tso*, at other places, is really brackish.

At *Camp CCCXIV*, everything was abundant; grass, fuel, dung of kyang and yak and water. The weather was curious. After a temperature of  $-21.9^{\circ}$  and a strong S. W. wind during the night and before noon, it began to snow at 11 o'clock a. m. The snowflakes were falling thick and fast, and everything again became white, and the air was so misty that nothing of the surrounding mountains could be discerned. In 1906 we had had nearly no snow before Christmas. Our experience of this winter, allows the presumption that the snow period of the winter is in January; particularly the latter half of the month. As soon as the snow began to fall, the wind ceased.

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MOUNTAINS AT CAMP 312



MOUNTAINS AT CAMP 312

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On *January 28th*, our course was E. S. E. for 17.5 km. After going 11.4 km., we reached a pass of 5,572 m., being, therefore, at 274 m. above the lake. The rate of ascent was thus as 1:42. From the pass to *Camp CCCXV*, 6 km., we had to descend 198 m., as this camp is at 5,374 m., the rate being here as 1:31.

The minimum temperature of the night sank to  $-34.6^{\circ}$ . The morning was clear, but the day, cloudy and windy. We directed our course to the mouth of a valley opening up from the east. The ground rises slowly and regularly, and consists of brownish red dust, sand and fine gravel. *Yapchan* plants are abundant the whole way. To our right, we have the snowy group mentioned above. The main watercourse of the valley, which goes down to the lake, is left just south of our route. A large herd of antelopes fled westwards. In the same direction, we beheld a part of the southern basin of the lake, at the southern shore of which, Rawling had camped. The pass, *Lungnak-la*, situated east of the southern-most part of the lake, and used by Bower and Rawling, is to be found 15 km. S. W. of the pass we now were approaching. The mountains to the north of our route are pierced by some small valleys, in the background of which we see the crest of a rocky range. The pass is a flat saddle. At its top we had a temperature of  $-17.2^{\circ}$ , a strong S. W. wind and fine dry snow driven by the wind. The view from this height, was not particularly encouraging, as the country seemed to be high and mountainous far away, without comfortable open plains or latitudinal valleys. Just S. E. of the pass, the mountains seemed to be broken by a narrow gorge, but we preferred to follow the flat hills eastwards. At the lee sides of terraces, a considerable amount of snow had been heaped together by the wind. Gradually we came out on a plain surrounded by mountains. It is difficult to tell in which direction it slopes. To the naked eye, it seems to fall to the north and N. N. E., though according to Rawling it falls south and S. W. In its eastern part, there was grass and much snow, the vegetation, being particularly abundant in the mouth of a little valley from the east. On the day's march, the living rock consisted of grey and red dense limestone as hitherto. Pan. 403, Tab. 71, taken from here, gives an idea of the mountains from N. N. E. to south. To the S. S. E., the country lay comparatively open to our march, but we had come to a very high part of the Tibetan plateau-land, a barren and desolate country.

On *January 29th*, we had 13.4 km. S. S. E. and S. E. rising from 5,374 m. to 5,480 m. or 106 m., being a rate of 1:126. We continued crossing the plain, the ground of which was rising in the direction of the road. The march was extremely monotonous. On both sides we had hills of moderate size. The weather was bitterly cold, the minimum temperature having been at  $-31.4^{\circ}$  and the wind blowing like a gale. In the morning the weather was clear, but soon the S. E. wind began and gradually went over to south and S. S. W. and finally S. W. Only

when the latter direction has been reached the wind grows to a gale. Usually we try to camp in the lee of a hill, but, as a rule, we are always exposed to this indefatigable wind. Such was also the case at *Camp CCCXVI*, where some little grass was found. During the last part of the highland plain, the snow lay some 20 cm. deep and was whirled up in clouds by the gale. Ice was not seen; all the water we needed we got from the snow. In the afternoon and evening, the clouds were very dark and menacing. The gale came to an end, it began to snow, and it snowed the whole night. Occasionally, a very violent wind swept across the mountains. In the morning the snow lay one or two feet deep in the high, latitudinal valley we had to follow to the S. E.

On *January 30th*, we continued in the said direction. 5,480 m. was a tremendous height for a camp, but leaving *Camp CCCXVI* we had to ascend another 88 m. to the very flat threshold situated 8.2 km. S. E. from this camp. The ascent was, therefore, at a rate of 1:93 which was, however, stiff enough at this altitude, in deep snow and with a dying caravan. From this pass we had 9 km. E. S. E. to *Camp CCCXVII*, where the height was 5,325 m. or 243 m. lower, which gave a descent of 1:37. The snowflakes continued falling thick and fast and nothing was to be seen of the surrounding country. Only occasionally, we could guess the existence of hills of moderate relative size on both sides, everything being perfectly white, the hills as well as the floor of this latitudinal valley. This pass, 5,568 m. high, was, according to my instruments, only 4 m. lower than that east of *Arport-tso*, though it was so flat that it was practically impossible to tell where we really crossed the point of culmination. Nor could I estimate the approximate breadth of the valley. Only S. E. of the pass, we marched along the base of the hills at its northern side. Here the snow lay deeper still, and our march was extremely heavy and slow. The temperature of the night had, on account of the snowfall, been only  $-24.2^{\circ}$ , and, on the pass, it was  $-14.0^{\circ}$ . Under such conditions as these, it is not easy to draw a map. It can, at the most, be only approximate. The poor and miserable grass that might exist here and there, was, of course, completely hidden by the snow. Erosion furrows and beds could not be seen, nor if we passed springs and ice-sheets. We had, however, no occasion to suffer from thirst even though it might be difficult to find fuel for melting it. If the snow had continued for some days and if the country in front of us had been covered with snow, it would very soon have become a question of life and death to our caravan.

According to Rawling's map, the ground hereabout falls to the south or S. S. W. In the driving snow and snow-fog, it was impossible to see in how far this was the case and where one had to march to reach falling ground. We, therefore, continued E. S. E., and thereby had to cross another threshold, this time quite secondary and situated in the left side-hills. It was, however, flat as a plain. The

range bordering our latitudinal valley on the north, is very rugged and rocky with steep pyramidal peaks cropping up out of the heaps of detritus. It was of a reddish yellow colour. To the right or south of our route, we had low rounded hills. Finally the valley becomes broad and open. The principal watercourse is crossed through 1 m. deep snow, after which we keep to the top of the left terrace where the snow is swept away by the wind. The bed follows the base of the southern hills. Several small furrows from the rocky range to the north go down to the principal bed. The ground was sand and fine gravel. In the mouth of a little valley to the south, some grass appeared, and here we pitched our *Camp CCCXVII*. The snow was less deep here than higher up in the valley. There was no wind, but it went on snowing. At 3 o'clock p. m. a regular gale came from the S. W. With indescribable fury it blew through the valley, and at the same time it snowed very fast. The temperature was at  $-16.4^{\circ}$ . It is difficult to imagine the hardships of such a journey. Only very little fuel could be found as everything was covered with snow. Eleven wild yaks were seen on a snowy hill in the neighbourhood where we camped. No other tracks of wild animals had been noticed. A little higher up in the valley we had seen a fireplace made of three stones where Tibetan hunters had camped, perhaps long ago. This was the first time since *Arport-tso*, that we had passed a place visited by natives. At 10.30 o'clock p. m. the severe snow-storm ceased. At 9 o'clock the stars were visible through the snow-fog.

On *January 31st*, we marched only 4.7 km. to the S. E., the valley falling 76 m. or at a rate of 1:62. The temperature in the night, had been down to  $-26.9^{\circ}$ ; it snowed again in the morning, and nothing could be discerned of the surroundings. We had, therefore, only to follow the chief erosion bed of the valley, which, a short distance below *Camp CCCXVII*, turns around a black projecting rock at the right side. The snow was now about one foot deep everywhere, and two or three feet in the erosion beds. In the mouth of a little side valley to the right, some yellow grass-straws peeped up through the snow. At another place the three usual stones proved that hunters had been camping, as the country is too high and too far north for nomads. The valley falls extremely slowly to the S. E. At a place where the wind had blown away the snow and the grass was good we made *Camp CCCXVIII*, at a height of 5,249 m. Fuel, consisting of plants and yak dung, was plentiful. Four wild yaks were seen retiring to the west.

Early in the afternoon *Shemen-tso* became visible to the S. E. The shoreline of the lake could easily be distinguished, though only on the northern side, for the southern disappeared in snow-fog. The plain just north of the lake, appeared to be dark as if no snow had fallen there. It, therefore, seemed probable that we were going to leave behind us the very high protuberance of the plateau-land, where the greatest amount of the snow falls in January. Ever since we had reached these

highest parts of the country, we had had snow, which was in accordance with our experiences from the winter of 1906—1907. On both sides of it, there was very little snow or none at all. At 3 o'clock p. m. it began to snow again.

On *February 1st*, we marched 16.7 km. S. S. E. and S. S. W. to *Camp CCCXIX*, where the height was 5,002 m. or 247 m. below *Camp CCCXVIII*, being a fall of 1:68. The temperature of the night was only down at  $-18.2^{\circ}$ , but it snowed continually and the sky was over-clouded. In the morning the clouds were so thick that it was quite dark, and it snowed continually nearly the whole day. The wind was very strong, but now came from the S. S. E. The snow was deep again, sometimes two feet, and the surroundings of the lake, which the day before had appeared dark and bare, were now quite white. Enormous quantities of atmospheric moisture are driven by the S. W. winds, in the form of heavy, compact clouds from the Indian seas across high Tibet. The precipitation no doubt decreases from west to east and from south to north. The highest parts of the country catch the greatest amount of precipitation, as we have found.

It would be easy to draw a map of the snowfall in Tibet, founded upon the experiences I have had. Very little material for such a map would be obtained from the observations of other travellers, as hardly anybody has chosen such a disadvantageous season for his journey as I. It is, however, of great interest to study the winter climate also, of such an inaccessible country as this. In spite of the abundant snowfall we had witnessed ever since the region west of *Arport-tso*, the amount of snow is never sufficient for accumulating and forming *névés* and glaciers, as would be the case under other conditions. This is due to the dryness of the atmosphere and the very strong evaporation. Only on the highest mountains, the snow is eternal. The rest evaporates and disappears early in the spring, without even forming floods in the beds and erosion furrows of the valleys. It is very likely that the greater part of the snow-sheet covering the country between *Arport-tso* and *Shemen-tso*, never gets an opportunity to melt and to flow down to the lakes in the form of water. Before the temperature of the spring has become high enough to melt the snow, the snow-sheet will already have disappeared by evaporation. An exception from this rule will probably only be found in the very highest regions, though even there, as for instance on the *Chomo-uchong*, the melting will proceed so slowly and gradually, that it will never give rise to any large volume of water in the brooks.

Our valley becomes broader and soon opens out to the extensive plain of the lake, where we follow broad and shallow beds going down to the N. W. shore of the *Shemen-tso*. The usual hard and dry vegetation of the highland steppes, is growing here in belts and ribbons between these broad watercourses. We steered towards the first promontory on the northern shore, but as the country thereabout

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N 21° W



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S 59° E



THE VALLEY DOWN TO RUKYOK FROM CAMP 382.

GEN SHIBU ET AL. PHOTOGRAPH





seemed rather barren, we changed our direction to the S. S. W. where grass appeared in the distance. Marching across the plain we saw several herds of *Pantholops* antelopes, some of them containing up to 40 individuals. Near the lake we pitched our *Camp CCCXIX* in an erosion furrow 1 m. deep and surrounded with good grass and fuel of all sorts. In the course of the day we had seen an old camp, and near the lake we found the marks of three Tibetan tents and a sheepfold of stone. Above the camp was a frozen spring where a herd of 30 kyangs was seen. In the night, *February 2d*, we had a temperature of  $-14.9^{\circ}$  only, due to the strong S. W. storm blowing and the uninterrupted heaps of compact clouds sailing over Tibet. For the sake of our animals we stayed here for a day, — an unusually stormy day; it was as dark as in the evening, and snow was driven across the plain by the gale, but no new snow fell. Of the surroundings, nothing was seen, not even the shore in our immediate vicinity. *February 1st, 2d, and 3d*, we stayed at *Camp CCCXIX*. At our arrival the day before, the weather was comparatively clear and I had been able to draw a panorama of all the surrounding mountains. It is reproduced on Pan. 404A and B and C, Tab. 72. To the W. N. W. and N. W. are hills of moderate size and N. N. W. is the entrance to the valley by which we had come down. To the right of it are the mountains bounding the shore plain of the lake to the north and N. E. Then follows the lake *Shemen-tso* with all the more or less rocky mountains rising on its shores and sometimes with old beach-lines visible in the distance. The next day, *February 3d*, after a temperature of  $-19.8^{\circ}$ , the weather remained the same. The southern part of the plain was nearly swept free from snow by this indefatigable gale, but on the lee sides of every hill, terrace or plant snow was heaped, as well as on the lee side of the tent. All mountain sides turning north, N. E. and east were quite white, unless they were too steep to give the driving snow a hold. On slopes turning south large portions were swept bare. The whole lake was frozen over and covered with snow. A small island seems to be situated in the western-most part of the lake. Two promontories, one from the northern shore to the E. S. E. and one from the southern, S. S. E. from our camp, are more marked features of the landscape.

On *February 4th*, we marched 15.6 km. E. S. E. along the shore. *Camp CCCXIX* is at an altitude of 5,002 m. The lake is at 4,960 m.<sup>1</sup> In the night the temperature was at  $-27.9^{\circ}$ , the air was perfectly clear with nearly no wind. The day was sunny and fine with only a little breeze from the S. E. Having passed the belt of vegetation near the camp, we marched on even ground of yellowish grey alluvial clay along the shore, traversed by a large number of shallow furrows and water-courses. About half the area of the plain was snow-covered. Most of the snow had

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<sup>1</sup> On the map, Pl. 17, it is 4,968, which is a misprint. *Cp.* the meteorological journal, p. 88.

been swept away by the strong S. W. wind and probably accumulated along the base and at the lee sides of the hills to the N. E. The snow-patches still left on the plain were tough and leathery like parchment and their surface was yellow from wind-driven, fine dust. Only in the furrows and especially at the lee sides of the terraces, the snow was blown together in greater masses. The shore-line runs fairly straight to the E. S. E. After some kilometers we leave behind the projecting rocky promontory of the southern shore, east of which there may be a rather deep-cut inlet to the south. This is, however, impossible to verify from our route. The southern shore of *Shemen-tso* has never been mapped. Deasy travelled beyond the mountains of the southern shore, Bower followed the northern, and Rawling surveyed at some distance from the northern shore.

The ground gradually becomes soft sand, perfectly barren, and perhaps inundated in the summer when the lake no doubt rises to a certain extent. At some distance from the shore, there are two old beach-lines. The red hills east of the plain come nearer to the shore, and finally form small, more or less detached, groups on the shore itself with capes and promontories. On the slopes of these hills the old beach-lines are very sharply marked, being at about 10 and 20 m. above the surface of the lake. They form a very characteristic feature of *Shemen-tso*, and may be seen nearly everywhere along its southern shore as two sharply drawn dark lines. Where the shore turns south and S. W., we ascend the top of the 20 m. terrace and finally march east and N. E. to *Camp CCCXV*. The reddish ridge running out on this little peninsula consists of reddish grey dense limestone of the same kind as the whole time since *Camp CCCXIII*. At several places along the shore of this peninsula, springs come up, and at such places there is no ice. At one place a spring came up, the water of which was not absolutely fresh. There was nearly no grass, but the common hard plants grew in abundance. The camp was at about 15 m. above the lake and just on the slope from the highest terrace. The view to the N. E. from *Camp CCCXV*, was very curious and reminded one most strongly of the benches of a Greek amphitheater. The intervals between the terraces were white with snow, but the terraces themselves, yellowish red from the colour of the limestone sand, gravel and boulders. This characteristic view is shown both on the accompanying sketch in water colours, and on Pan. 405, Tab. 72. Pan. 402A and B, Tab. 71, constitutes the immediate continuation of the latter. To the E. N. E. it shows rather high snow-covered mountains. To the east, S. E., and south it represents the view of the lake and the world of mountains forming a frame around its shores. In the fine weather of the day, the *Shemen-tso* indeed represented a scenery of rare Tibetan beauty and majestic desolation.

On *February 5th*, we marched 8.6 km. along the shore E. N. E. and S. E. to *Camp CCCXVI*. It was like a rest to our 15 surviving ponies and mules to follow

the shore of the lake and thus be spared from rising ground and high passes. The contour line of the shore is comfortable, without indentations, with the only exception of the peninsula of *Camp CCCXX*. In this respect the southern shore seems to be much more complicated with deep inlets and projecting capes and rocky peninsulas. To judge from a distance, this shore reminded me of *Chargut-tso*, *Pang-gong-tso* and *Rakas-tal*. So much seemed obvious, that *Shemen-tso* was one of the largest lakes of western Tibet. The whole lake was frozen. Only at a first little cape, there was a hole of a spring. The cape with terraces visible to the right of Pan. 405 consisted of living limestone and had to be climbed by our tired animals. East of this cape we stick to one terrace the whole time, with the highest terraces to our left. The hills retire somewhat from the shore, leaving a narrow stripe of plain between their gravelly base and the lake. The amount of snow decreases gradually to the east, and only at lee slopes of terraces and erosion beds traversing them, the drifted snow is more considerable. Then the material is again hard clay, absolutely barren. There is no grass during the whole march, only some *yapchan* plants. No signs of human life. Of animals, we only saw hares, jack-daws and some small birds. Occasionally dung of kyangs was seen. From *Camp CCCXX*, a little black ridge was seen running out due east in a flat cape. We had this cape in front of us during the latter part of the march and hoped to find some grass at its lee side. But only the usual hard plants which are excellent as fuel, were found. Still we camped here only 2 m. above the lake. The black ridge consisted of darkgreen quartzitic schist. The temperature had been at  $-22.7^{\circ}$  in the night. At 10.30 o'clock a. m., the S. W. storm began. At 3 o'clock p. m. the whole landscape disappeared in a haze of dust. Before that happened, I had had time to draw Pan. 406A and B, Tab. 72, showing the mountains from north over east and south to S. W.

On *February 6th*, we made 12.3 km. E. S. E., still following the shore of *Shemen-tso*. *Camp CCCXXII* was about 8 m. above the lake. The night had been calm with clouds and a temperature of only  $-19.5^{\circ}$ . In the morning a very thin sheet of snow covered the ground and soon disappeared. We followed the excellent marching ground between the terraces consisting of sand or clay and some gravel. Just east of the camp, we crossed a broad and shallow erosion bed coming from a larger valley to the north. The lake becomes a little narrower as we proceed, and the mountains on the southern shore develop their details. The plain of the northern shore becomes broader. Farther east, the northern hills again approach the shore. At their base we found a series of small stone cairns on a straight line, built by Tibetan antelope hunters. In a little rock was a grotto, and from beneath a slab of schist, the brook from a spring streamed forth in the same way as the source of the *Indus*. It carried, at the most, half a cub. m. of water per second and, as it

had a temperature of  $+7.9^{\circ}$ , it kept the lake open for a short distance from the shore. This little affluent of *Shemen-tso* is thus continually running winter and summer. Here dung of sheep was laying about. East of this point some very scanty grass made its appearance, together with the usual other plants. *Camp CCCXXII* was situated in a very desolate region. The weather was as usual. The strong S. W. wind began at 9 o'clock a. m., and, one hour later, we had a very lively snowfall. At the camp a lonely kyang was grazing.

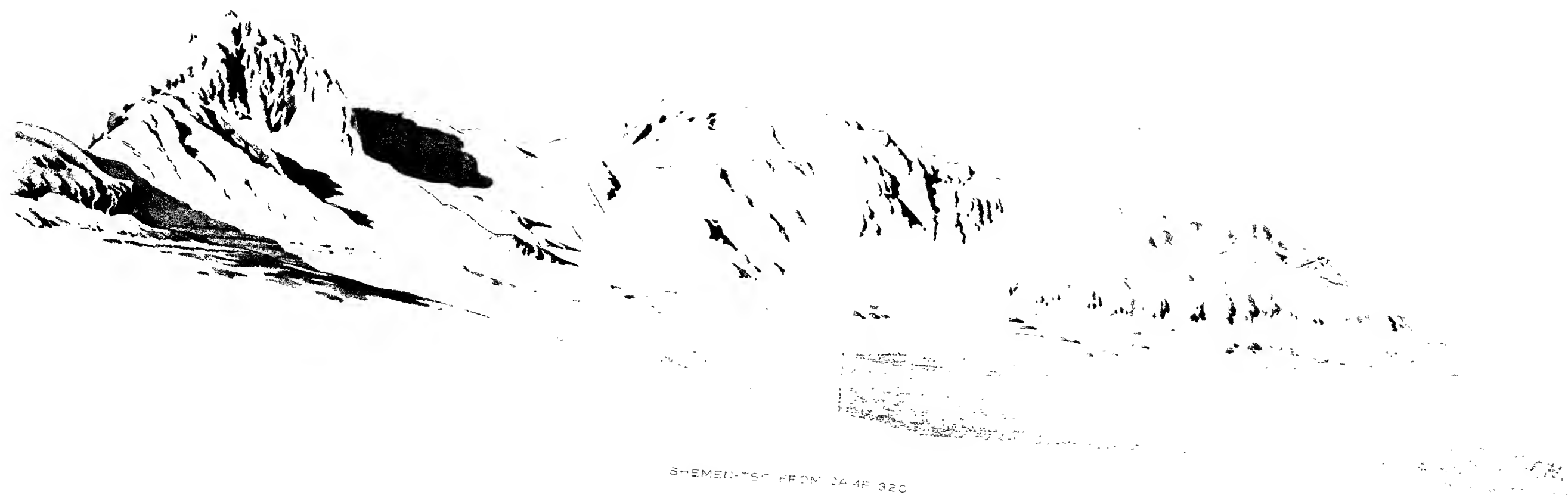
On *February 7th*, we made 8.3 km. S. E. We follow the same latitudinal valley as hitherto, a large part of which is occupied by *Shemen-tso*. After a temperature of  $-22.9^{\circ}$  in the night, we had a very fine day, the sky being nearly clear, except for a few small, white clouds now and then. Only a very light S. W. breeze was blowing and occasionally it was nearly calm. At some distance from the camp, the barrenness of the lake shore ceases and a rather thick and dense steppe of the customary hard plants begins. The eastern end of the lake is left behind with its little flat peninsula. The clay ground hereabout is modelled by the winds into tables and terraces with furrows between. The soil of the steppe consists of gravel, traversed by small beds bound to the lake. Only in these beds, there is still some snow, the rest of the soil is bare. In the southern part of the latitudinal valley, a shallow and broad erosion bed seems to be destined to the lake. In the same direction, four wild yaks were seen. To our left extends a large and open arena, or rather the mouth of a northern valley with a small black group of hills in its middle. On this plain, kyangs and antelopes were numerous, as well as hares. Near the base of a red hill to the east, the grass was good, and as some snow was to be had, we made our *Camp CCCXXIII*. The absolute height of this camp, calculated from my observations on the boiling point thermometer and the three aneroids, was 4,896 m. which cannot possibly be correct, as it is not in accordance with the altitude of the lake or 4,960 m., and from the shore the ground, of course, rises, though extremely slowly, towards the east. *Camp CCCXXIII* must, therefore, be a few meters above the surface of the lake. This discrepancy must be due to the great change which had taken place in the weather, the atmospheric pressure being quite another than during the stormy and cloudy days. I have, however, thought best not to change the figure, as it would influence either the altitude of the lake or the heights of the following camps.

The panorama from *Camp CCCXXII*, is shown on Tab. 73, 407A and B. To the north we have the mountain group situated just north of the camp. To the right of it, is the arena or plain with the little hill in its middle. To the S. E., is the direction of the latitudinal valley and of our march to *Camp CCCXXIII*. To the south and S. W., is the lake and the mountain range on its southern shore. Pan. 408A, B and C, Tab. 73, is taken from *Camp CCCXXIII*. On it we have



10. IV

10. IV



SHENEN-TSE FROM CA 4E 320





another aspect of the mountains south of the lake. To the W. N. W., we have the perspective of the mountains surrounding the basin of *Shemen-tso*. At about N. 30° W., are the ridges and ramifications to which the group, »N. 3° E.» on the previous panorama, belongs. To the N. N. E. and N. E. are the mountains bounding the extensive arena plain, and continuing to the east and E. S. E. To the S. E., is the prolongation of the latitudinal valley and the direction of our march to *Camp CCCXXIV*. To the S. S. E., south and S. S. W., are the mountains which belong to the system south of *Shemen-tso*.

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## CHAPTER XVIII.

### A LATITUDINAL VALLEY STRETCHING EAST-SOUTH-EAST.

On *February 8th*, we proceeded 8.1 km. S. E., descending from 4,896 m. to 4,874 m. or 24 m., which is as 1:338. The night temperature was down at  $-28.3^{\circ}$  and the weather was very favourable. The good grass soon ceases, but the other plants continue. The soft ground lies in very flat, nearly imperceptible, undulations, and is traversed by a large number of very small and shallow erosion beds, most of them containing some snow. On the slopes of the mountains to our left, the old beach-lines of the lake are very readily visible and they continue still some distance up the valley. In fact we, therefore, were only a few meters above the surface of *Shemen-tso*. The tracks of kyangs and *Pantholops* antelopes were very numerous. A little farther on we found an antelope that, perhaps only a few minutes ago, had been caught in a trap. Tibetan hunters must, therefore, be close by. On the eastern side of a grass-covered, very flat and low hill of soft material, we camped at the side of the principal erosion bed of the valley, which contained a frozen pool of fresh water. About 1 km. west of *Camp CCCXXIV*, the antelope hunters had their two tents. These were the first human dwellings we had seen since we left *Shayok* 64 days ago. The tents were inhabited by 9 persons, 2 men, 2 women, 3 girls and 2 boys. Their camping place was called *Rio-chung*. Two or three days' march farther on in this valley, were the gold mines of *Gätsa-rung* and *Bota-rung*. No other hunters' tents existed in this district. To the S. S. E., it would be about 8 or 9 days to the next tents, belonging to nomads from *Senkor*. To the E. S. E., up the great valley, we would have some 20 days to nomads; the ground would be favourable, only one pass to cross, grazing and water to be had everywhere. On the whole, they did not seem to know very much about the country in that direction. Our hunters possessed only 150 sheep and 4 dogs, but no yaks or ponies. On their wanderings, all their things, even the tents, are carried by sheep. They pass the summer in a region called *Yildan* situated 5 days S. W., and belonging to

the territory of *Rudok-dsong*. In the beginning of December, they had arrived at *Rio-chung*, and intended to stay to the middle or end of March. The grass was quite sufficient for their 150 sheep. According to their experience, unusually little snow had fallen this winter.

From *Rio-chung* or *Camp CCCXXIV*, Pan. 410A and B, Tab. 74, was sketched. To the N. W. is the open prolongation of the latitudinal valley containing *Shemen-tso*. From there and the whole way around across north and east to S. E., are the mountains bounding the valley to the N. E. To the S. S. E. and the S. E., is the prolongation of the valley. The rest of the panorama belongs to the mountains on the S. W. side of the valley.

On *February 9th*, we marched 11.3 km. S. S. E. The ground rose 27 m., as *Camp CCCXXV* had an altitude of 4,901 m., the rate was as 1:418. The temperature of the night was at  $-28.6^{\circ}$  and the weather was calm and clear. The hunters had advised us to stick to the left or southern side of the valley where the ground was said to be more even, at the right side the ground was more undulated and hilly. We, therefore, first crossed the large erosion furrow with the pool, keeping to the south, and then turned S. E., leaving the mouth of a considerable tributary valley from the south, to our right, in the background of which rather high mountains were visible. A flat slope from the southern hills, is crossed, and the direction then becomes south, following the base of the southern hills. East of us an extensive plain extends between the mountains. Its ground consists of dry, barren grey clay, which has become modelled in terraces and furrows by wind and erosion. Soon we came across an ice ribbon between the lowest terraces, at first about 10 m. broad, then gradually broader south-eastwards, and sending arms and branches in both directions. This ice was formed by a little brook from an open running spring. Several cairns had been built in this vicinity, and at the spring a stone wall was erected, from which hunters shoot animals coming to drink. Here and there are small patches with tolerable grass. Farther on a second little hillslope is to be crossed, only some 20 m. above the floor of the valley. To the N.  $75^{\circ}$  E. from this point, a large right tributary valley joins our valley. In its lower part, immense ice-sheets are seen, and in its background there is a considerable snow-covered range, the *Aru-tso* Range. In the angle between the two valleys, there is an isolated mountain. The whole way up the terraces at both sides of the valley are very well-marked, at about 12, 15 and 20 m. respectively above the floor of the valley. They have been eroded by the rivulet of the valley. We continue on the western side of the ice ribbon which gives the illusion of a real river. The space between the terraces and the ice is overgrown with grass. The right terrace is of clay, the left of fine gravel. The old terraces are more distant. At the side of a second spring, there is also a wall for hunters. Of wild animals now only hares were to

be seen, but abundant dung of wild yak and kyang proved that these animals are no rare guests in the valley.

Our valley is broad and its rise, imperceptible. It is altogether filled with this fine grey clay spoken of above. To the south, it is bordered by high snow-covered mountains. In this region no explorer had been before, as Bower travelled from *Shemen-tso* to *Aru-tso*, and Rawling only crossed the valley farther east.

At the first spring the living rock had been greenish grey felspar-sandstone; at the second little slope we crossed, it was dark schist partly containing much mica. Pan. 411A and B, Tab. 74, is drawn from *Camp CCCXXV*. To the N.  $35^{\circ}$  W., are some of the hills of the left side. To the north and N. E., are the considerable mountains of the right side of the valley. Between N.  $35^{\circ}$  W. and N.  $4^{\circ}$  W., the valley turns to the left or N. W. and goes slowly down to *Shemen-tso*. To the east and S.  $81^{\circ}$  E., is the isolated mountain block standing between the two valleys. To the S. E. we see the continuation of the large valley by which we marched to *Camp CCCXXVI*, the next day. To the S. S. E. and south is another part of the range on the left or southern side of our valley. The panorama, therefore, shows that the latter is bounded by rather high ranges.

The march of *February 10th*, took us 7.9 km. S. E., and now the rise of the valley became more sensible, though still very gradual, or 40 m., as *Camp CCCXXVI* had an altitude of 4,941 m., the rate was thus 1:198. After a temperature of  $-22.4^{\circ}$  in the night, the weather remained as fine, clear and calm as the days before. The characteristic features of the valley were the clay beds, the small hills and undulations of clay and the clay terraces. Grass and ice were abundant, and the landscape had not the wild, barren and desolate appearance which we were accustomed to. The valley becomes broader, and is as Rawling, who has crossed it meridionally, says, a real plain surrounded by mountains. But when he says that water is scanty, he must either have passed here in a very dry year, or crossed the valley on a line where water is not in sight. For, since the valley of *Shayok*, we had not come across so much water as here. It was even a little too much now, as we had constantly to cross ice-sheets, one of which was about 100 m. wide. Some 10 or 12 springs were passed in this short distance, all of them with open water. One of them had grown like a kind of »ice-volcano«, a conical mound of ice, from the »crater« of which the water streamed out. Having crossed the principal ice bed near *Camp CCCXXV*, we had grassy steppe nearly the whole way. To the east, in our immediate vicinity, the isolated group mentioned above was left. From it several springs come down. The main bed of the valley with its ice, is to our right. From W. N. W., a large tributary valley opens out; at its southern promontory the remains of a Tibetan camp were to be seen. Fuel was abundant, both vegetable and dung of wild yak and kyang. This place seemed to be more suitable

in every respect for long camping than *Rio-chung*, but obviously the antelopes, of whose flesh the hunters were living, were more numerous at the latter place. Occasionally the hunters seemed to visit this part of the valley as well, for rather fresh footprints of two men were seen at a place where the ground was sandy. We are wandering through a real labyrinth of clay mounds and terraces between which there are patches of grass and sheets of ice. To our left we have a broad and short arena valley from which the largest ice-sheet comes, obviously from springs. On the hills in the background of this arena and at a short distance from our route, three or four stone huts appear. On the hills above them, there are a few cairns, one of which is cubic; on the little threshold that is bounding the valley on the north, there is also a cairn. This seems to be the place which Rawling calls *Rungma-tok*, and probably identical with one of the gold-mines or both, which had been mentioned to us by the hunters of *Rio-chung* and called *Gätsa-rung* and *Bota-rung* by them. During the winter, of course, nobody dwells at the gold-mines. In the summer the place must be favourable compared with other gold fields, for here grass, water and fuel is to be had in abundance.

We continue along the base of the hills which bound the gold valley on the east. Immediately to our right is a large ice-sheet formed by a little brook from springs which keeps open a long way. It carried about a quarter of a cub. m. per second and was frozen only along its banks. The water flows very slowly, but at least it proved that this valley, which to the naked eye appeared perfectly horizontal, rises to the S. E. The right terrace of the bed of this brook, on the top of which we marched along the base of the hills, was unusually well developed and nearly 10 m. high. Finally we went down into the bed and crossed it at a place where it was again frozen across. Along the part of its course where it is open, springs of a comparatively high temperature come up in the bed and on the right bank. On the left bank, we camp amongst good grass, fuel and on sandy ground. Hares were numerous, and a few ravens followed the caravan as usual.

In this part of the valley, there was nearly no snow at all. Only on slopes looking north, some white strips were still to be seen. At noon the weather changed to the worse. The whole sky being overclouded and a fresh S. W. wind beginning to blow. At 1 o'clock p. m. the temperature was only  $-3.6^{\circ}$ , and had, the previous day, even been at  $-2.5^{\circ}$ .

The living rock at *Camp CCCXXVI*, was the same dark schist partly rich in mica as before. The pebbles in the bed were dark grey sandstone. The ring of mountains surrounding the camp is represented on Pan. 412A and B, Tab. 74. Of special interest here is the gap in the southern mountains to the S.  $7^{\circ}$  W., which may be the transverse valley by which Rawling travelled. To the right of it are the mountains along the southern side of the valley. Between N.  $61^{\circ}$  W. and the

gap at the extreme left of Pan. 412B, is the latitudinal valley by which we had marched in the course of the day. To the N. N. W., north and N. E., the high erosion terrace at the right side of the watercourse of the latitudinal valley is readily visible. To the E. S. E. is the upper continuation of the same valley, by which we had to march the next day. S.  $55^{\circ}$  E. is a peak cropping up above the horizon and situated at a considerable distance.

On *February 11th*, we continued 12.7 km. to the E. S. E. rising 114 m. or to 5,055 m., which is at a rate of 1:111, or considerably steeper than hitherto, though still very gradual. The march is monotonous in the latitudinal valley. The ground is nearly even, and, at any rate, the undulations existing, very flat. To our left or north are small hills of loose material. Again a large ice-sheet is passed in a bed that we cross. It contains fine gravel. The ground otherwise is sand and sparse gravel, traversed here and there by shallow furrows and beds. The snow again increases though it remains only in beds and at lee sides of terraces. The grass soon ceases altogether, but *yapchan* is still growing though not in abundance. Fresh footprints of three men were seen, probably antelope hunters. At the ice-sheet had been a Tibetan camp. Thrice we saw herds of kyangs. Hares, ravens and small birds were also seen. The region which now was so desolate and quiet must be comparatively well inhabited during the summer when the gold-diggers come and stay. In the mountains, barring our progress, three passes seemed to be situated, all high, though we got the impression that the northern-most would be the most comfortable. To the north, a rather large tributary opens, and in its background, the snow-range of *Aru-tso* again shows its mighty crest. Rawling may have travelled by this valley. We follow the main watercourse of the valley, which higher up contains ice. To the north or right side, it is bordered by low hills with some grass. Behind a projecting red cape from these hills, we made our *Camp CCCXXVII*. Here the ice had been sanded over, proving that hunters or nomads with tame animals had passed a short time ago. In the neighbourhood was a sheepfold. The temperature of the night had been  $-25.8^{\circ}$ . The morning was fine but already after 8 o'clock, a fresh west wind began to blow. The living rock at *Camp CCCXXVII* was dark grey arkosic sandstone; in the bed below, the gravel consisted of reddish brown quartzitic sandstone. From this camp Pan. 409, Tab. 73, was sketched, showing a not very promising country to the east, as the ground was rising everywhere and we would soon have to cross a pass.

On *February 12th*, we proceeded 10 km. to the E. S. E. The ground rose 262 m., as we started from 5,055 m. and *Camp CCCXXVIII* had a height of 5,317 m. The rate is, therefore, as 1:38, which, however, chiefly is due to the place we chose for our camp, being at the side of the floor of the valley. Otherwise the rate of ascent would have been less steep. The minimum temperature of the night was  $-23.6^{\circ}$ .

It had snowed again and the whole country was white. The snow lay, as a rule, only a few centimeters deep, but in ravines and furrows, half a meter and more. Very likely this snowfall only touched the highest parts of this high protuberance of western *Chang-tang*, and probably no precipitation fell around *Shemen-tso* and other comparatively lower regions. In the morning half the sky was clear, and half covered with light white clouds. At 9 o'clock a. m. the whole sky was overclouded and to the south and S. W., very dark and compact clouds appeared. To the east and E. S. E. as well, the weather looked very menacing and a sort of snow-fog seemed to surround the mountains in the vicinity of the next pass in front of us. In the course of the day, however, no snow fell and there was nearly no wind.

After crossing the ice-sheet at *Camp CCCXXVII*, we ascend the flat slopes of the hills along the southern side of the valley where the rise becomes more and more sensible to our tired animals. There is some grass on these hills. To our left we have the bed of the main watercourse of the valley with its ice-sheet and to the north of it a considerable range with eternal snow and even a few quite rudimentary glaciers. The ground was rotten from rabbits' holes. The tracks of the small rodents were seen everywhere in the fresh snow. *Pantholops* antelopes were very numerous in flocks on the floor of the latitudinal valley, and amongst them a few individuals of the small *Gazella* antelopes were grazing. As it proved afterwards, it would have been better for us to follow the latitudinal valley eastwards instead of climbing to the little threshold of 5,317 m., a direction which we thought should bring us more quickly to the definite pass. From the little threshold we behold to the east and S. E., an open arena plain, to which we had to descend again and cross before entering the pass valley. From here it was, however, impossible to tell in which direction the pass was situated. We still did not know how far this high part of the *Chang-tang* was stretching, nor whether the *Snowy Range* of Bower and Rawling was in connection with it. The general stretching of the ranges in this part of Tibet was N. W.—S. E. and W. N. W.—E. S. E., as could be expected, but obviously there existed also meridional ranges and ramifications. The whole morphology of the latitudinal valley we had now been following so many days, proved, on the other hand, that the pass in front of us was a water-parting threshold in the valley itself, of the same kind as those of which we had crossed so many in the late autumn of 1906.

So far, we had had no reason to complain of the grazing grounds in the valley and our last 14 caravan animals, the survivors of 40, had taken the five last days without losses. Around *Camp CCCXXVIII*, however, the grass was very poor on account of the 5,317 m. height. Pan. 413, Tab. 75, shows the high mountains to the north, east and S. E., and to the E. S. E. the direction of the pass.

On the night of the *13th of February*, the temperature was at  $-29.3^{\circ}$ . The weather remained fine. The minimum of the night of *February 14th* was  $-30.5^{\circ}$  and the weather remained good. On this day we made 11 km. to the E. S. E. We ascended only 28 m. from *Camp CCCXXVIII*, as *Camp CCCXXIX* had an altitude of 5,345 m., which would be a rise of 1:393. This is due to the fact that we had to go down from the first little threshold to the floor of the latitudinal valley. A short distance from *Camp CCCXXVIII*, we cross a second little threshold, being at 15 or 20 m. above the camp, and from there we go rather steeply down to the floor of the main valley. From the threshold it was difficult to say which direction would be the most favourable. To the S. E. another little threshold was seen, and beyond it a larger valley, which no doubt leads eastwards to a pass. To the east, a high pass was seen, to which a rather narrow valley ascends. I decided to make an attempt to cross it. The arena valley was, therefore, traversed in the direction of the mouth of the pass valley. The ground was good with the exception of the rabbits' holes, most of them still filled with snow. Antelopes and kyangs were numerous; of other animals, only a fox was seen. At *Camp CCCXXIX*, just at the entrance of the valley, there was some very poor grass. A well-marked erosion furrow follows along the left or southern side of the valley. From the right another bed enters, at the side of which a ring wall of stone proved that Tibetans had camped. On the mountains to the north there is much snow.

On *February 15th*, we travelled mostly eastwards, and only the last bit to the S. E., for 17.8 km. in all. From *Camp CCCXXIX*, at 5,345 m., we have 8.4 km. to the pass, the altitude of which is 5,655 m. or 310 m. above the camp. The rate of ascent is here as 1:27. On the eastern side the slope is much less steep. From the pass we had 9.4 km. to *Camp CCCXXX*, which was at 5,556 m., or 99 m. below the pass; here the rate is only as 1:95. After a night at a temperature of  $-30.3^{\circ}$ , we started up the valley on the top of the right terrace of the bed. This, however, soon becoming pierced by snow-filled ravines, we went down into the erosion bed itself which was full of sharp-edged gravel, and occasionally had a little ice-sheet left by the last water of the little brook in the autumn. Springs were not seen at all. In the valley there was surprisingly little snow, whilst the hills on the sides were nearly white. The rock was dark schist, or fine-grained schistous quartzite. The direction of the valley is nearly due east without sharp windings. From the sides several small tributaries enter. The slope becomes more and more steep. The pass has the form of a very flat, open platform, steep to the west and with a gradual fall to the east. The gravel on its top consisted of grey phyllitic schist, containing quartz.

The view to the east is not encouraging. The descending valley is bordered on the left or north, by a range with fine, not very high, peaks. Some kilometers farther on, the valley turns to the S. E., and just in the corner, a tributary enters,



N. 75° E

E

S. 75° E

N. 75° E

N. 75° E



THE ONSET OF A STORM IN NORTHERN TIBET JULY 11, 1903

S. 63° W

S. 75° W

S. 40° W. N. 87° W. JULY 14, 1903

N. 75° E

N. 75° E

N. 75° E



THE SURLA RANGE IN THE TIBETAN ALPS AS SEEN FROM THE PLAIN



coming from a little glacier. To the W. N. W., the direction from which we had come, the view was magnificent, resembling a sea of wild red waves, mostly covered with snow, as the snow principally accumulates at the lee sides. *Shemen-tso* was hidden by mountain shoulders and ramifications. The valley descending to the east, appeared nearly horizontal to the eye. The ground here consisted of fine gravel and coarse sand. As could be expected, the amount of snow was greater on this side of the pass, especially where tributaries from the left side had to be crossed, it was no easy task to march through the deep snow. In these high regions, there was no sign of life, neither animals nor vegetation. The country was absolutely barren. The bed of the main watercourse of the valley was shallow and follows the right or southern side. At the corner where the valley turns to the S. E., the living rock is grey and reddish coarse-grained granite. From this place the valley, which hitherto has been fairly broad, becomes very narrow, and one has to march in the bed itself, which is full of gravel and blocks. Here the snow on the lee side of the mountains to the right or western side of the valley, lay accumulated in real drifts, as high as tents, and it was not easy to avoid the deepest passages. On the slopes of the left side, yellow moss began to appear. But there was no grass. Dung of wild yak occasionally was seen. It was pulverized and mixed with some meal and given the mules. Just above *Camp CCCXXX*, a little rudimentary glacier was seen on the western range. Strong and violent gusts of wind blew down from the N. W., like cascades, into the valley.

This pass, which killed three of our fourteen animals, was one of the highest I had ever traversed. It is the eastern water-parting pass of the basin to *Shemen-tso*, which, therefore, has a very considerable drainage area. The orographical structure and general morphology of western Tibet is, as we have seen, quite different from the relief forms in the eastern parts of the country. In the east it never happens that one finds transverse thresholds of such enormous height in the latitudinal valleys. One gets the impression that a kind of very broad meridional protuberances run across the whole country.

On *February 16th*, we continued down the valley to the S. E. for 7.4 km., descending 134 m. or to 5,422 m. which was the altitude of *Camp CCCXXXI*. The rate of fall was here 1:55, or considerably steeper than in the upper part of the valley. The minimum temperature was only  $-22.2^{\circ}$ . The ground of the valley is covered with sharp-edged gravel and small blocks and boulders, the whole lot more or less hidden by snow, making marching tiresome and fatiguing. Sometimes the whole valley is snow-covered, and only occasionally, a stone breaks the white sheet. The erosion furrows are also hidden. The fresh snow, driven hither by the wind, is very loose, the older snow tough like parchment. By and by ice-sheets are crossed in the principal bed, though no springs are seen. The valley does not

wind much. It runs S. E., and is, therefore, like an accumulator for the snow that is driven by the S. W. wind across the hills. Sometimes it was hard work for us to force our way through these snow-drifts. Just below *Camp CCCXXX*, the living rock was dark greyish green schistous quartzite. About halfway, it consisted of grey quartz-biotite-diorite (hornblendegranite). Near *Camp CCCXXXI* it was grey, phyllitic schist. The latter formed perpendicular walls, about 10 m. high, at the sides of the valley, and above them were the screes from the mountains above. The bed of the watercourse in the valley is, therefore, sharply eroded, and has a breadth of from 30 to 50 m. As the bed occupies most of the valley, this is, therefore, rather narrow. Finally the valley opens up a little and in its background to the S. E., a more isolated mountain group is seen. On both sides of it, the country appeared to be rather open. At *Camp CCCXXXI*, there was some poor grass and the yellow moss which could be used as fuel. A path was seen on a slope, probably worn by wild yaks. Of human beings, we saw no signs. Looking up the valley one would think that no nomads ever use this horrible way and this high pass. Probably there are other, more comfortable passes in the neighbourhood leading from the east to the drainage area of *Shemen-tso*.

On *February 17th*, our march continues for 15.0 km. to the E. S. E. and S. E. The ground falls 147 m. or to 5,275 m. which is the height at *Camp CCCXXXII*; the rate of slope is thus as 1:108. The figures show how very slowly the great and broad protuberance on which we had travelled for such a long time slopes down to regions of the *Chang-tang* with a more moderate height. It is, of course, very tiring to men and animals to remain for a long lapse of time on heights which exceed the altitude of *Mont Blanc* by several hundred meters.

The night temperature went down to  $-24.1^{\circ}$ . The whole day the sky remained perfectly clear. In the morning the wind was S. E. but soon went over to S. W. and blew with the violence of nearly a full storm. Heaps of snow had been accumulated in the lower part of the valley, and sometimes it was hard work to force our way through the drifts. The valley was full of sharp-edged gravel and blocks. Here and there the snow had been swept away from the ice-sheets in the bed. At one place along the left terrace, some mounds of gravel proved that gold-diggers had been at work. Such a place as this has, of course, a name, though as the whole country now was uninhabited, we could not ascertain any geographical names at all. Below this place, we went up on the top of the left terrace and the flat slopes of the left side-hills, gradually leaving the bed at an increasing distance, and finally seeing the last of it where it disappeared to the S. E. In its lower part, it became broader and shallower, and its terraces, lower. It would be impossible to tell in what direction the great open arena across which we now travelled, is sloping, for to the naked eye it seemed to be perfectly level. Judging from the situation of

its very shallow erosion furrows and beds it, however, seems to fall from north to south. On all sides, it is surrounded by mountains. Those to the south are comparatively low. Between the latter, there is, no doubt, a passage by which the watercourse of the valley pierces its way southwards. This would also be in perfect accordance with Deasy's map. For several days he travelled in a meridional valley which he calls *Damtang-lungpa*. The watercourse of our *Camps CCCXXX* and *CCCXXXI*, is obviously one of the uppermost feeders of this meridional valley, and somewhere in the eastern part of the arena plain, not far from *Camp CCCXXXII*, we must have crossed Deasy's route.

To the E. S. E., was the opening of the valley to which we steered. It seemed to lead to a very flat threshold beyond which, far away, a mountain was visible. This seemed to indicate comparatively level ground for a few days' march. The arena valley was about 10 km. broad and 8 km. on our road. It would have been very comfortable for our march if it had not been snow-covered to nine tenths of its area. The snow lay one foot deep, and in erosion beds which we had to cross, two or three feet. Sometimes the surface of the snowdrifts was so wind-beaten, frozen and hard, that our animals could pass without breaking through. Grass was seen only at a place in the western part of the plain, which otherwise has only some moss and *yapchan* plants. Only antelopes were grazing, two wolves were seen; of yaks and kyangs only the dung. Of human visits no sign, not even a path. Entering the valley on the east side of the plain, we very slowly ascended to the little threshold which is so flat that it is impossible to tell where it is situated. On its eastern side the slope is just as gradual to *Camp CCCXXXII*, where the vegetation was the same as hitherto, and the amount of snow not quite as great. From this camp, Pan. 415, Tab. 75, is drawn showing the valley to the N. 66° W. in the direction of the little threshold. Pan. 416, Tab. 75, is a view of the continuation of the valley to S. 68° E. the way we had to travel the next day.

It is a very characteristic and interesting feature that the latitudinal valleys are so well developed in this part of western Tibet as we had found on our crossing nearly the whole way from the Lake of *Aksai-chin*. Of course we had met some irregularities in this long distance, and we had had to cross two very high and several lower passes and thresholds, but this does not interfere with the fact that the mountain ranges in western Tibet follow the orographical laws so well known for the stretching of western *Himalaya* and western *Kara-korum*, and dictate the N. W.—S. E. running of the latitudinal valleys. Particularly from *Shemen-tso* our valley had been regular and typical. In one respect the latitudinal valleys of Western Tibet are, as a rule, very unlike those of Eastern Tibet, *viz.* that the former are much narrower as *e. g.* the valley of *Camp CCCXXX*. This, of course, simply depends upon the fact that the mountain ranges of Western Tibet, on account of

general tectonic and mountain-building laws, are much more pressed together than in the central and eastern parts of Tibet.

On *February 18th*, we took a new step in the prolongation of the great latitudinal valley to the E. S. E., marching 10.1 km. and descending 94 m., as *Camp CCCXXXIII* had an altitude of 5,181 m., the rate was 1:107, the same slow gradient as usual. The minimum temperature had been  $-20.8^{\circ}$ . In the morning the wind came from S. E. but soon turned around to S. W. The soil of the valley remained the same as before; heaps of gravel, small blocks and snow. The greatest amount of snow was always found where the valley was at its narrowest. This snow is swept down to the lee side of the mountains to the S. W. A large part of the valley was as narrow as a gorge between mostly rounded hills of no great altitude. One has to march in the erosion bed itself, the course of which, in accordance with the valley, is rather winding. In the mouth of one of the small tributary valleys from the sides, there was a square of stones, inside of which a tent had been pitched. In the narrowest part of the valley, the living rock was dark grey and black quartz schist. In a tributary valley near *Camp CCCXXXIII*, the rock seemed to be red granite; the gravel in the bed of our valley was largely granite.

Finally the narrow valley again opens out, and we are able to leave the bed and to travel on the flat slopes of the mountains on the left. Here the grass was tolerably good, and all sorts of fuel to be found. As the slope was much exposed to wind and sunshine, it was nearly free from snow except at the lee sides of terraces. Three flocks of *Pantholops* antelopes and one kyang had been seen in the course of the day.

From this camp, Panorama 417, Tab. 75, was drawn, showing the black ridges with low pyramidal peaks and, here and there, strips of snow. An accompanying water colour panorama gives an idea of the landscape to the east and S. E. as it appeared from the interior of my tent at about 1 o'clock p. m. when one of the most violent storms I have ever witnessed, came sweeping with its full fury across the highlands of Tibet. It came, as always, from S. W. Thick clouds of dust and sand were driven north-eastwards and the farther mountains soon disappeared. The nearer hills, of which some had a singular red colour, could still be discerned, particularly their higher parts and crests, proving that most of the solid material was swept along the ground. The sky was clear and blue without even the smallest cloud. Even fine gravel was drumming against my tent, and the round balls of the kyangs' dung were flying uphill like paper. The temperature rose to  $-1.4^{\circ}$ , which was the highest we had experienced since December 6th, in the *Shayok* Valley, or about two and a half months ago. In the evening twilight, the storm came to an end, and at dark only a dying breeze was felt.

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## CHAPTER XIX.

### FROM LEMCHUNG-TSO TO SENES-YUNG-RIGMO.

After having crossed Deasy's route, which now had been left behind, we had in front of us one of the greatest unexplored and perfectly unknown regions of Tibet.

On *February 19th*, we marched 18 km. to the E. S. E. across a country which still, morphologically, could be regarded as belonging to the same enormous latitudinal valley as hitherto. The ground was now falling 248 m. as *Camp CCCXXXIV* had an absolute altitude of 4,933 m., the rate of the slope thus being as 1:73. The minimum temperature was  $-20.1^{\circ}$ , the sky perfectly clear. Already at 7 o'clock a. m., the S. W. wind began with the force of half a storm. The dust was whirling about and rose here and there like clouds, but the landscape was only partly hidden. The ground was favourable to our march though again pierced by rabbits' holes. The soil consisted of dust, sand and fine gravel with some grass. It is, therefore, flat, soft ground without living rock within reach. Just to our right or south, is a broad shallow watercourse, and beyond it and E. S. E., some of the hills visible on the last panoramas. The amount of snow decreases as we proceed eastwards; to begin with, it is still to be found at the lee side of terraces and in small erosion beds as well on some slopes falling to the north. But farther east it ceases altogether. Only on the little hill south of *Camp CCCXXXIV*, there is a little patch left. It is exactly the same distribution of snow as we had found when approaching *Shemen-tso*, where the amount of snow decreased as the absolute height became lower. It is surprising that such an insignificant difference of height plays so important a part.

North of our course were low, irregular and detached hills, and in this direction it would obviously not have been difficult to proceed. On the plain south of our route we could count at least 300 antelopes. Towards the end of the march we saw a little lake to the S. E., obviously the *Lemchung-tso*. As the country might become barren in the direction of the lake, we made camp, *CCCXXXIV*, at the base of some low hills where snow could be had. To the S. E., beyond the lake,

high and difficult mountains appeared to be situated. The country seemed to be easy both north and south of the lake.

In the mouth of a small northern valley in the beginning of the march, we had seen dung of sheep and other signs of nomads' visits. The S. W. wind was very strong the whole day, and swept enormous quantities of dust along the plain. Towards evening it abated. At *Camp CCCXXXIII*, the living rock was yellowish red conglomerate and reddish brown quartz schist.

On *February 20th*, we marched 11.3 km. E. S. E. descending 113 m. or to 4,820 m. which was the height of *Lemchung-tso*. The rate is as 1:100. The night temperature was down at  $-28.2^{\circ}$ ; the wind kept on blowing, though not as strong as the previous day. The sky was perfectly clear. Of our caravan,  $\frac{1}{4}$  or 10 animals remained.

We steered towards the little isolated mount, on both sides of which the lake was visible. As the lake seemed to be rather extensive to the south, we preferred to march along its northern end. The plain was free from snow, except two or three small patches. Several broad and shallow erosion beds were crossed, with *yapchan* plants on both sides. Antelopes were numerous, a few kyangs passed by, and hares were living here in greater numbers than anywhere else. The soil consists partly of clay, partly of sand, and has, in the latter case, a good deal of grass. Before reaching the little hill, we crossed two beach-lines, being at about 15 and 10 m. above the lake. In the first slope of the little hill, was a grotto where nomads had left a hand-mill and two yak-skins. Following the base of the hill in the direction of the shore, we had the northern-most part of the lake to our left. The clay deposits had here been modelled by the winds and weather in the most fantastic way. Here the shore was barren, but west of the lake and on the slopes of the little hill, the grass was better than hitherto. *Camp CCCXXXV* was pitched on the very shore-line of the lake where a fresh-water spring came up; its water was 2 or 3 degrees above zero, and a few square metres were, therefore, open in the ice of the lake. The shore-line was directed S.  $35^{\circ}$  E. and along it, was a path obviously trodden by men. Dung of sheep was seen. To the S.  $46^{\circ}$  E., the country seemed to be very even and comfortable for our march. On a slope of one hill, an *Ovis ammon* fled southwards. The living rock of this hill was light grey, dense limestone.

The panoramas taken from *Camps CCCXXXIV* and *CCCXXXV*, give a good idea of the appearance of this part of the country. On Pan. 418A and B, Tab. 75, we see between N.  $71^{\circ}$  W. and N.  $41^{\circ}$  W., the opening of the latitudinal valley and to the N. W., north, east and E. S. E., the low irregular mountains bounding the *Lemchung-tso* basin in this direction. From the camp itself, neither the lake nor the hill is in sight as it is hidden by small undulations of the ground. S. S. E. and south are hills of no great size. From *Camp CCCXXXV*, the two water colour



panoramas on the accompanying plate were taken. The upper one shows a view to the north and N. N. W., the lower a view to the S. E. Only the little northern basin of *Lemchung-tso* was in sight from this camp.

On the night of *February 21st*, the minimum temperature was  $-20.5^{\circ}$ . The wind in the morning came from N. E. and went, as usual, gradually over to S. W. with the strength of nearly a full storm. The sky was clear, not the slightest sign of a cloud. But the air got slowly filled with dust, and the landscape, which the day before had been so readily visible all around, now nearly disappeared in this thick haze of dust. As a rule the nights were calm. A hundred meters from the shore, the ice was very thick, even 58 cm. did not suffice to get through, and the hole was abandoned. In the open part near our shore, the water was as fresh as could be wished, but here the little affluent of the spring came out, and may have influenced the taste of the water of the lake. *Lemchung-tso*, however, no doubt has fresh water, otherwise the ice would hardly be so thick. Other signs of nomads' visits at the lake were found during our rest-day at this camp, *viz.* a sheepfold filled with dung of sheep.

On *February 22nd*, we marched 9.3 km. S. E. At *Lemchung-tso* the height was 4,820 m., at *Camp CCCXXXVI* 4,878 m., thus giving a rise of 58 m. or at a rate of 1:160. The night temperature was at  $-24.4^{\circ}$ . In the morning the wind was S. E. We continued between the west shore of the lake and the base of the small hills of grey, dense limestone. The soil is gravelly. After a few minutes we found, to our surprise, that we had already reached the southern shore of the lake. We ascended the top of an old beach-terrace and saw that a promontory of the little hill group fell down to the very shore of a larger lake in our immediate vicinity. This was the lake we had seen from the neighbourhood of *Camp CCCXXXIV*. From the platform of the terrace, we went down on its southern side along a similar terrace slope to the shore of the southern lake, which was white with salt. This lake was much larger than its neighbour, though still of small size. It was only partly frozen; in the middle the water, of a bright and beautiful green colour, was quite open, and certain parts along the northern shore were not frozen. The lake is bitterly salt. We, therefore, have here a fresh-water and a salt-water lake quite near to one another, or a pair of lakes of the kind that is by no means rare in Tibet. In such cases the fresh-water lake is always situated at a level a few meters above the salt one and drains to it. In the case of *Lemchung-tso*, the drainage, which certainly exists, must be subterranean through permeable layers of sand, and perhaps only temporary, when the basin gets filled in the summer. At any rate, there was no superficial connection between the two lakes. To the south the salt lake was bounded by dark brownish hills of rounded forms and moderate height, with narrow strips of snow here and there, and obviously quite barren.

Leaving the lake, we very slowly rise to the S. E., following a well-trodden path and crossing others, the latter probably of wild animals. The soil is gravelly and hard. A little beyond half-way, there is a very insignificant upheaval of the ground, only some 20 m. above the surface of the salt lake, and probably the last remains of an old beach-line. To the south we have the western cape of a detached hill which seems to reach the vicinity of the southern shore of the lake. Both to the S. E. and east, the country is open. According to Deasy's map, we could expect to come across high snowy mountains in this direction, but still none were in sight. From Deasy's route, which we now had some 45 km. behind us where it was nearest to the west, it might, however, have been difficult to estimate the real distance of the snowy mountains he has seen. *Camp CCCXXXVI* was pitched on the plain near the little hill, on the slope of which was sufficient snow for our supply of water. In the course of the march, two Tibetan ponies came running to our caravan and accompanied us to the camp. They had obviously run away, perhaps from far, for no tents, nor any other signs of nomads or hunters were in sight.

The weather had been good and cloudless, but at 1 o'clock p. m. a storm broke out from the west, with greater fury than I had ever experienced in Tibet. The whole country disappeared and even of the nearest hill, nothing could be seen. At the same time the sky became thickly overclouded, and the bright day was changed into twilight. Impenetrable clouds of yellowish red dust were swept along the ground. The approach of the storm was noticed with a sound reminding one of that of a jet of water put into a fire, though much stronger. An iron spade and an iron pot were taken by the wind and could hardly be caught; only a very strong wind is able to remove such heavy objects laying on the ground.

A very common form of soil on the *Chang-tang* plains is fine gravel in a thin layer on the top of the dust. This arrangement is, of course, a result of the sorting activity of the wind which carries away the dust, and leaves the gravel behind. Such was also the case with the steppe around this camp; it looked as if a vacuum cleaner had swept across the soil. We had already got, and would still get, ample opportunity to settle the fact that the first months of the year, which are also the coldest part of the winter, are the most windy of the whole year. We had made the same observation the year before, on the way from *Ngangtse-tso* to *Shigatse*, though the wind in those eastern and more protected parts was not quite as strong as here on the open plateau-lands of the *Chang-tang*.

An hour before the storm broke out, I sketched Pan. 419A and B, Tab. 76. The first part of it, to about east, shows the mountains which bound the plain on the north. To the E. S. E. is the continuation of the great latitudinal valley we had followed for such a long time. S. E., south and S. W., are the mountains bounding the plain to the south, W. S. W. is the detached hill near our camp, and

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N 24° W

N



THE LENCHUNG-TSO FROM CAMP 335

S 46° E

S 35° E



THE LENCHUNG-TSO FROM CAMP 335



N. 68° W. is a flat peak belonging to the mountains on the western shore of *Lemchung-tso*.

On *February 23rd*, we marched 14.3 km. E. S. E. on very slowly rising ground or as 1:125, *Camp CCCXXXVII* being at 4,992 m. or 114 m. above *Camp CCCXXXVI*. We were, therefore, again approaching a transverse threshold in the great latitudinal valley. The temperature of the night was again down at —28.8°. A fresh western wind was blowing during the day, and the air was not clear. In the evening, as usual, the wind died away, and the night was calm.

The plain of the latitudinal valley seemed to be quite level, and the ground, consisting chiefly of fine gravel, was very favourable for the march. There are nearly no undulations. Grass is growing everywhere, and antelopes are very numerous. Dung of kyangs, but none of yaks, was seen. The hills north and south are not high, and their small valleys are broad and flat. In this part there are great divergences from Deasy's map, the country being too far from his route. His *Snowy Range* to which we ought to have some 20 km. more, was not yet visible. The great valley seems here to be about 15 or 20 km. broad. Its principal erosion bed was running at some distance south of our route. In the mouth of a little, broad valley at the north side, or to the left of our course, two black tents were seen at a distance of several kilometers. At the base of the southern hills, we discerned a square stone building, though it was too far to tell whether it was a hut or a *mani* wall. At *Camp CCCXXXVII*, we found grass and fuel; and some snow was still left in an erosion bed from the north. From this camp, Pan. 420A, B and C, Tab. 76, was sketched. It begins with the southern mountains, from S. 15° W., and continues S. W. and west. To the W. N. W. we have the plain open ground of the extensive latitudinal valley with mountains in its background, as it is turning to the right or towards the regions of *Lemchung-tso*. Then, to the N. W., north and N. E. are the mountains bordering the valley on the north. E. N. E. the country seems open; N. 86° E. is the northern-most point of the southern mountains; beyond this point, our route turns E. S. E. To the south there is a broad, open space between the ramifications from the mountains.

On *February 24th*, we made 11.8 km. E. S. E., still rising 126 m. or to 5,118 m., being a rate of 1:94. The latitudinal valley continues in perfect accordance with the general building of the orographical systems of western Tibet. It has the same general features as the day before and since *Lemchung-tso*, is broad, and rises very slowly. If the existing maps had been correct we would on the march of this day have crossed a »Snowy Range», and a second one ought to have been in sight in front of us. The ground is very favourable, being mostly fine gravel of schist, and sometimes dust with vegetation and rabbits' holes. As we are rising again, there is more snow than the day before, and drifts remain in every furrow

and behind every terrace; at a few places it was even 1 m. deep. Between the furrows, there is no snow at all. Paths of wild animals are numerous. The antelopes are seen by the hundreds, and in larger flocks than ever. The kyangs come to this plain at another season, their dung was common but the animals were absent. Of nomads' visits, we only once saw the signs, *viz.* an old camping place. The mountains to the south are moderate; at two places they seemed to present an easy passage to the south. The hills to the north are somewhat higher, but not considerable. At noon a very strong wind began from W. S. W. Pan. 421A and B, Tab. 76, was drawn from this camp. It gives a representation of the contours of the low hills both south and north of the valley, the stretching of which, both westwards and eastwards, is readily visible.

On *February 25th*, we accomplished a section of the endless latitudinal valley in which we were at a loss to tell in what direction the ground was falling. Our course was a little north of due east and the distance, 10 km.; *Camp CCCXXXVIII* we had found to be at 5,118 m., and *Camp CCCXXXIX* was at 5,108 m. The difference of 10 m. would give a fall at a rate of 1:1000. During the march I was under the impression that the ground was rising eastwards, and only the next day, *February 26th*, it became quite evident that we had passed, somewhere between the two last-mentioned camps, the transverse threshold of the latitudinal valley which, to the east, marks the boundary of the drainage area of *Lemchung-tso*. The principal erosion furrow of the latitudinal valley which we crossed between *Camps CCCXXXVII* and *CCCXXXVIII*, is obviously fed by small tributary beds from the southern and northern mountains. Then follows, east of *Camp CCCXXXVIII*, the quite imperceptible threshold, east of which the small feeders from both sides join the principal bed flowing eastwards a short distance north of *Camp CCCXXXIX*.

The minimum temperature of the night,  $-20.2^{\circ}$ , was somewhat higher than usual as it had snowed, and the night had been cloudy and windy. In the morning the whole ground was covered with a very thin sheet of snow and so were the hills to the north. The landscape had exactly the same morphological features as the days before. The ground no doubt was still rising a few kilometers before it reached the imperceptible water-parting. So much was perfectly clear already from the start, that this time we were not approaching a high pass, but only a transverse and very flat threshold of the same kind as in the autumn of 1906, in the latitudinal valley east of the *Aksai-chin Lake*. This is the great difference between high passes and flat thresholds in latitudinal valleys. Where such a valley is narrow, as between *Camps CCCXXXIX* and *CCCXXX*, the transverse water-parting pass is very high; whilst when the valley is broad and open like a plain, the water-parting pass is extremely flat and low and, as a rule, difficult to determine; in the latter case the rise of the floor of the valley is very gradual and slow, and may take several days. In

Central and Eastern Tibet this latter morphological type is the rule. In Western Tibet, the first case is the rule, all depending upon the general orographical relief of the country. In the regions where we now travelled, both forms were met with, as the one, of course, gradually goes over in the other as one proceeds to the east.

On the section to *Camp CCCXXXIX*, the ground was a little more undulated than had hitherto been the case. Most of the march we followed the erosion bed which drains to the east. The water-parting threshold, therefore, seems to be situated only a short distance east of *Camp CCCXXXVIII*. The fresh snow very soon disappeared and then, as usual, only remained at protected places. Grass was growing everywhere as also seems to be a characteristic feature of the broad latitudinal valleys. Antelopes were living here in large numbers. After having followed the northern bank of the principal erosion furrow for several kilometers, we entered the bed and again left it at an interesting point. Here we found about 50 pits or holes dug in the ground, the fresh appearance of which made it plausible that they had been worked, at least many of them, the last summer. It was again one of the very primitive gold mines which are so common in Western Tibet. The holes were from one to five meters in diameter and about one meter deep. Some of them were old, as could be seen from their rounded edges. In the neighbourhood was a little stone wall behind which some hunter used to look out for antelopes. In a small tributary valley from the south, a stone cairn had been built at the side of a sheepfold. Only 5 minutes from the first gold mine, there was in the slope at the right side of a little tributary, a second one of the same kind, which did not seem to have been worked for many years.

East of the gold mines we had to cross several shallow valleys from the south with rounded slopes between them. On their west or lee sides, some snow was always accumulated. Tents or old camps were not seen. In one of the valleys, where everything necessary was to be found, we made *Camp CCCXXXIX*. From a point with a commanding view to the east, a higher mountain could be seen, but nothing that could be called a »Snowy Range». Eastwards, the country seemed to be very favourable for our progress. The W. S. W. wind this day began at noon, and was strong and biting cold. A short panorama, 423, Tab. 77, was drawn to the N. W. and N. E. showing the tops of the very flat conical peaks and rounded ridges.

On *February 26th*, we proceeded 11.4 km. eastwards, and now at last the ground decidedly fell in the direction of the route. *Camp CCCXL*, 4,876 m., was 232 m. below the previous camp, and we descended thus at a rate of 1:49. The minimum temperature was  $-25.2^{\circ}$ .

From the camp we still had some very flat protuberances and the valleys between them, to cross. The latter, as well as the one in which we had passed the night, turned to the right or N. E. and joined the principal watercourse of the valley which

slowly falls eastwards, but still at a much steeper gradient than we had experienced for several days. We then followed the southern side of the principal watercourse. Here were several remains of Tibetan camps, and the usual stones for the cooking pot, tent stones, and sheepfolds. A little lower down we again passed a gold mine, where a little canal, about 100 m. in length, had been dug from the brook of the bed, and led to a furrow of flat stone plates on which the gold dust is washed out. Now there was only ice in the bed; in the summer spring water is, no doubt, constantly running.

At the gold mine the valley begins to become as narrow as a gorge, very deep-cut and enclosed between nearly perpendicular rocks of no great height. Just east of *Camp CCCXXXIX*, the living rock consisted of dark quartz schist; just below the gold mine it was greenish grey sandstone, and east of it we had greyish red quartzitic sandstone. Somewhat lower down, the loose gravel of the valley consisted of yellowish white limestone and flint. Where the valley is at its narrowest or only 5 m. broad, we have to march on the ice in its bottom. Here and there the ice forms small cascades in which steps have to be made with the axes. After this we follow the northern side a bit. Some of the tributary valleys are very deep-cut, like gorges. Higher up the slopes to the south, the hills are more rounded and covered with grass, which, however, becomes more scarce towards the end of the march. In the valley there is now an open spring and an extensive ice-sheet. On the top of the terrace at the left side we passed two big sheepfolds. At several points stone cairns had been built. Human signs became more common, and still the country remained as desolate and abandoned as ever. Once, not far from the last camp, we had seen quite fresh footprints of a man who had gone up into the valley of a southern tributary, where, perhaps, a tent was situated.

Finally our direction becomes S. E., we cross the ice a few times, and after that stick to the right side, crossing some small tributaries from the south. At an abandoned Tibetan camping place, there were heaps of sheep dung in the folds; very welcome, as no other fuel was to be found. The valley now becomes broader, and where the ice and the snow seemed to come to an end, we camped. Only from N. N. W. to S. E., the view was free. It is to be seen on Pan. 422, Tab. 77. Eastwards the country looked unusually easy and favourable for our march. For several days we would obviously have comfortable ground. The mountains E. N. E., were very far away, and no high peaks were visible at all. To the S.  $79^{\circ}$  E., there was also a gap, through which no mountains at all could be seen in the distance. In spite of the strong wind, there was not much dust in the air, and even the farthest mountains could be clearly seen in light blue tints. Of wild animals, nothing but hares and a raven were seen in this region. In the night wolves were heard.

On *February 27th*, we made 12.7 km. E. S. E., still descending 207 m. or to 4,669 m. (*Camp CCCXLI*), being at a rate of 1:61. The minimum temperature



was at  $-19.6^{\circ}$ , unusually high, as the absolute altitude was lower than hitherto. The W. S. W. was fresh; at 9 o'clock a. m. the sky was overclouded after a clear night.

Just at *Camp CCCXL*, our narrow valley again goes over into a broad and open latitudinal valley, which to the north, is bordered by comparatively low hills between which are nearly plain gaps at two or three places. The country is, therefore, very flat, and its character of a plateau-land is obvious. The ground falls to the E. S. E. and S. E., to a depression, from which the floor of the latitudinal valley rises again in the same direction. The ground is hard and consists of finest gravel or coarse sand; sometimes we cross belts of very scarce, coarse gravel. Grass is growing on the plain, though less abundant, as we proceed S. E. Hares are abundant, and foxes live in the hills. Kyangs were grazing in enormous numbers, at least one thousand were seen at a time. Of antelopes, only four individuals could be seen.

At *Camp CCCXL*, we ascend the left terrace of the brook of the narrow valley. It is about 8 m. high and not pierced by a single ravine of a tributary, which is due to the fact that the northern mountains are so far that their water-courses disappear on their way across the plain. The right terrace, on the other hand, is pierced by several small tributaries from the southern hills, along the base of which the principal bed continues to the E. S. E. The ice and snow in its bottom soon comes to an end. The bed gradually becomes more and more shallow and is soon lost sight of. At the base of a first projecting promontory from the southern mountains, the bed of a larger watercourse is crossed, probably the continuation of the one at *Camp CCCXL*. At its S. E. side the grass was good, and some other plants of the highland steppe were also growing there. In the broad valley opening here from the south, was a large shallow watercourse. A herd of kyangs at this place numbered 133 individuals and there were four other herds of about the same numbers. In a small valley farther on, a lonely tent was seen. *Camp CCCXLI* was pitched at the foot of a little detached hill in front of the southern mountains. The living rock of these mountains was grey and reddish white dense limestone. The panorama drawn from this camp is of interest and may be regarded as very characteristic of these parts of interior Tibet, from a general morphological point of view. It is represented as Pan. 424A, B and C, Tab. 77. To the N.  $73^{\circ}$  W. is the mouth of the large southern valley where the herds of kyangs had been seen; N.  $54^{\circ}$  W. is the first projecting limestone rock which we had passed. N.  $40^{\circ}$  W., the country is very open, and it is not unlikely that a branch of the latitudinal valley continues in this direction, which may be in connection with the valley of *Lemchung-tso*. N.  $37^{\circ}$  W. a comparatively high cupola-shaped mountain is rising. From N.  $25^{\circ}$  W. across north and east, we see the flat ridges and ramifications bordering the latitudinal valley on the north. E. N. E. and E. S. E., the country is very open. From S.  $75^{\circ}$  E., S. E., south and S. W., we have the hills on the southern side of the

valley, interrupted by some fairly broad and flat tributary valleys opening to the great latitudinal valley. The landscape is typical, showing the result of the levelling action of a denudation that has been going on for long periods. Here, as in many other parts of interior Tibet, we have indeed a very good example of what Penck calls the »upper denudation limit» above which the destructive action does not allow any mountains to rise. The panorama also very clearly shows how the different ridges, for instance, those to the N.  $47^{\circ}$  E. and S.  $66^{\circ}$  E., are cropping out from the débris which form very flat conical screes sloping extremely slowly from the base of the mountains down to the midst of the plains or latitudinal valleys. The depressions and cavities between the mountains which have been filled up with enormous quantities of loose material, occupy a much greater area than those parts which, still, in the form of mountains, rise above the beds of deposits. Winds and weather, frost and sunshine, and the great amplitudes of temperature between day and night during the warmer months, and between winter and summer, and finally the action of rain and running water and melting snow, all these are factors co-operating towards the levelling of the country, the lowering of the mountains and the filling up of the depressions. The relative heights, therefore, in the course of time decrease. The procedure is irresistible and uninterrupted, though, of course, extremely slow. If one factor ceases to be active, as for instance the running water in the winter, another will begin with its work, as do the strong winds and storms in the cold season. The final result at which the destructive powers are aiming, is to bring the mountains and the valley plains at one and the same level. This would be the ideal plateau-land, a status which, however, never will be reached, for the peripheric erosion is with the same energy working its way towards the heart of the still self-contained plateau-land without outlet to the ocean.

At the place where we had seen one tent, 2 or 3 km. W. N. W. of the camp, there proved to be two, inhabited by 2 men, 2 women and 2 children. They had arrived from *Gertse* two months ago and would remain one month more. They reckoned 6 days to *Gertse*, where the *Gertse Pun* or chief of the district is living in a stone house, not in a tent, at least during the winter. Their dwelling place near *Camp CCCXLI*, they called *Senes-yung-rigmo*, and the region of *Camp CCCXL*, *Takmar*. These nomads were very poor. They asserted that they only possessed 70 sheep and goats, 6 yaks and one dog. They were not hunters. If we continued S.  $48^{\circ}$  E., where the country, as seen on Pan. 424C, Tab. 77, was open, we would in two days reach a fresh-water lake where nomads were dwelling. Continuing farther in the same direction, we would probably come across nomads at several other places, all of them from *Gertse* and *Senkor*. But if we continued eastwards, we would not meet anybody for some ten days, nor find any springs or snow.

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## CHAPTER XX.

### TO NAGRONG.

On *February 28th*, we marched 17.7 km. S. E., rising 90 m. or to 4,759 m., being at a rate of 1:197. During this day's march, we finally abandoned the great latitudinal valley which we had followed for so long a time. It continued to the E. S. E., as is shown on Pan. 424B, Tab. 77, perhaps for a very long distance. Now we turned S. E. up through the very broad and open valley which also is to be seen on the same panorama, and which may be regarded as a branch of the one we hitherto had followed. To begin with, the ground seems to be absolutely horizontal, consisting of yellowish grey clay washed down from the southern mountains, and at some places occasionally forming extremely shallow pools, in which the fine clay is deposited. Such pools, no doubt, disappear in two or three days. Here and there a thin layer of sand lies on the clay. Grass is common, and kyangs are numerous. The ground slowly begins to rise not far from a place where a well had been dug. We approach the southern mountains, which, as usually in this region, are red. From them some shallow watercourses come down and are crossed by our route.

Extremely slowly we are approaching a threshold which, in this direction, is the water-parting of the basin of *Senes-yung-rigmo*. At a greater distance N. E. of our route, is the mountain group or ramification, which also bounds the threshold to the N. E., and belongs to the ridge which separates our new valley from the one we saw stretching eastwards. The country is extremely flat and the rise of the ground is imperceptible. In two of the northgoing furrows, there was some snow, the rest of the ground being quite bare. To the right of our route, two tents were pitched, and farther on, a third. Fifteen yaks were grazing in their vicinity. It would be quite impossible to tell whether we crossed a threshold and where it was situated. Where the country to the S. E. began to open at a greater distance, we probably were at our highest point, though the ground itself looked perfectly even. We camped at the lee side of a little detached hill where we found just as much snow as was sufficient for our water supply. Here, nomads had been camping. The living rock was the same limestone as before. The S. W. wind was blowing the whole

day with the violence of a storm and the sky was overclouded. Of the landscape, only the nearest mountains were visible.

On *February 29th*, we had a march of 11.7 km. S. E. On this section the ground descended 126 m. or to 4,633 m., being a rate of 1:93. Thus at least it became clearly visible that we had crossed a flat threshold, and were now descending towards the centre of a new depression. The minimum temperature had been at only  $-15.5^{\circ}$ , for the night had been cloudy, and it had snowed. About half the area of the even ground was white, the hills nearly completely. In the morning, we had a fresh S. E. wind, which after 9 o'clock a. m., went over to S. W. and at noon had grown to one of the severest storms we had experienced so far. The clouds swept quite along the ground, and were, as a rule, very low. Only occasionally, the surroundings came in sight.

After we had passed the opening between low hills, it became quite evident that the country sloped to the S. E. To the left or N. E., we have the range separating our valley from the old one. To the south at a greater distance, are higher mountains. Between our route and these southern mountains, a depression seems to be situated, containing what seemed to be a lake, though it may have been an optical illusion caused by the clouds. We continue S. E. towards the eastern prolongation of this depression where two small lakes, or rather pools, are situated. A large herd of *Pantholops* antelopes and a lonely kyang fled as we approached. To our left a flock of about 100 sheep with two shepherds, appeared. Near the shore a man was driving 6 yaks loaded with ice to a tent in the neighbourhood. Crossing two old deformed beach-lines, we reached the N. W. shore of the eastern lake, which was called *Lumbur-rigmo*. It was all frozen over except a few places where springs came up. The grass in this region was not so good as hitherto. Fuel was scanty. The nomads living here were 9 persons from *Gertse*; they had 200 sheep and some yaks and seemed to be poor. A few kilometers eastwards, were two tents from *Senkor*. The 100 sheep we had first seen, belonged to them and had only arrived to drink from the little lake. Otherwise, the road to the east was regarded as unfavourable; no tents would be found, and the grass was bad. To the S. E. we would have two days to the little lake, *Yakrung-tso*, »The lake of the yak valley«, in the surroundings of which were several tents. The latter, however, were difficult to find, for they, as a rule, were hidden in small valleys and rarely pitched on the open plains. The nomads of *Lumbur-rigmo* were also hunters, as could be seen from their guns, knives and skins, and flesh of five *Pantholops* antelopes. As soon as the spring gets warm, they travel five days westwards to the region of *Sogbarong* where they pass the summer. In the autumn they again return to *Lumbur-rigmo*. Usually only half of the household is wandering to these part of the *Chang-tang*, taking with them most of their sheep, goats and yaks, whilst the other half remains at

*Gertse*. As we had only 3 ponies and 6 mules left, we bought 12 sheep to carry the remaining part of our provisions and some luggage.

From *Camp CCCXLIII*, Pan. 425A, Tab. 77, was taken.<sup>1</sup> N. 61° W., it shows low hills at the southern side of the valley, the open prolongation of which is seen to the N. W. To the north, N. E. and E. N. E., is a flat mountain group that from here seems to be rather isolated, though it is in connection with the range between our old and new latitudinal valleys. To the east, E. S. E. and S. E., the country is open.

Regarding the weather, the S. W. storm began on *February 29th*, at noon with the greatest violence. In the night the minimum temperature was only  $-13.4^{\circ}$ , the highest since December 6th. On *March 1st*, the storm continued as strong as before and broke out at 8 o'clock a. m. Its violence at 1 o'clock p. m. was undescrivable and magnificent. The sky was thickly overclouded, and of the surrounding country nothing could be seen, not even the tents of my men which were pitched at a distance of 6 m. from mine. The next night the temperature was at  $-19.9^{\circ}$ , it snowed, and at 7 o'clock a. m., *March 2nd*, the S. W. wind was blowing again as hard as ever. The whole sky was covered with dark, heavy clouds, and heaps of dust, mixed with snow, were driven across the highlands. The weather was such that it would have been impossible to continue our journey. In the evening the wind dropped low and the night was nearly calm. The temperature now fell to  $-23.4^{\circ}$ . In the morning, *March 3rd*, the weather was good and clear, but already before 7 o'clock a. m. the wind began with the same force as before. Still I decided to make an attempt, and started to the S. E.

This day we accomplished 10.7 km. S. E., rising 127 m., as *Camp CCCXLIV* had a height of 4,760 m.; the rate being at 1:84. The little fresh-water lake, *Lumbur-rigmo*, therefore, indicates the lowest part of a basin, to the S. E. edge of which we were now proceeding. We had not been so low down as at *Lumbur-rigmo*, since December 19th. The contour-line of the lake is very irregular, sending narrow apophyses in all directions. At several places, »ice volcanoes» have been formed where springs come up and freeze gradually in the shape of cones. Amongst the clear blue ice are terraces and platforms of clay, reminding one of the *Luma-ring-tso*, which I had passed in 1901. The ground then consists of grey clay and fine gravel, probably inundated in summer. After crossing a belt of good grass, the ground is hard, fine gravel, and the ascent, though very slow, becomes perceptible. The great latitudinal valley continues eastwards, whilst our course continues S. E. in the direction of a threshold in the mountains which bound the valley to the S. W. Grass, though scanty, grows everywhere. Several small erosion furrows

<sup>1</sup> Pan. 425<sup>B</sup> is, by mistake, noted as taken from *Camp CCCXLIII*. It cannot now be identified.  
34. 1V.

are crossed, and finally we enter a somewhat larger bed, being from 10 to 15 m. broad. At its left side or lee terrace, some snow was accumulated. *Camp CCCXLIV* was pitched at the eastern base of a little detached hill where we had some protection from the wind. Tibetans had camped there before. Grass and fuel were good and snow remained on the slopes. The bed had at its left side, a terrace 1 m. high. To the north, east and south, Pan. 426A and B, Tab. 78, was sketched. It shows, to the N. W., the depression of *Lumbur-rigmo*; to the north and N. E., the mountains which, to the north, border the eastern continuation of the latitudinal valley; N. 65° E. is the open gap of the latter. N. 79° E. is the first projecting hill belonging to the mountains south of the valley. To the S. E. the country also seems to be very flat and open, though the ground rises in this direction to a threshold. To the south and S. S. W. is the continuation of the southern mountains.

On *March 4th*, our march goes 11 km. S. E. The ground rises for 7.6 km. to the threshold of 4,886 m., or 126 m., being a rate of 1:60. From the threshold, we had 3.4 km. to *Camp CCCXLV*, being at a height of 4,748 m. and, therefore, 138 m. below the pass; the rate is here as 1:24. The storm continued the whole night and the whole day, though not quite as strong as before. The temperature was only  $-13.8^{\circ}$  in the night.

Behind our hill, two men had a tent and were watching 400 sheep belonging to a Tibetan from *Senkor*. E. N. E. in a furrow, there was another tent. We slowly approach the southern range, and have to cross innumerable erosion furrows gathering from small valleys and from the slopes, joining one another, resembling the branches of a tree. As usual, they contain drift snow at their lee sides, sometimes deep and sometimes troublesome to cross. There is also a good deal of snow on the ground between the furrows. To our left kyangs and antelopes were seen. The whole way, there is grass. Looking back towards *Lumbur-rigmo*, one could see the sand- and dust-laden wind like brown and reddish yellow veils sweeping across the plain, giving the impression that the wind was much stronger on the even ground than here in the vicinity of the hills. On the threshold, which is very flat, a cairn had been built. On its eastern side, a winding erosion furrow went down, rather deep-cut and with comparatively steep slopes on both sides. It is joined by numerous small tributaries. The principal bed which we follow, contains much drift snow. To our left a rather low ridge stretches E. S. E., to the right the mountains gradually seem to become lower and finally to disappear in a large plain, the eastern boundaries of which cannot be seen in the haze of dust. Our descending valley also emerged into the plain, and as grass, fuel and snow are more likely to be found near the base of the hills, we stopped at the lee side of a little mountain, amongst blocks of grey quartz-biotite-diorite (hornblende-granite). On the threshold the living rock was greyish green, very weathered, phyllite with veins of quartz.

From the camp nothing was seen of the landscape; everything disappeared in dust. Only the next morning, I was able to draw a panorama, 427, Tab. 78, from N. E. to south. It gives a view of the great plain to the S. E. which is bounded at a great distance by low mountains. On the other side of the hill of our camp, there was a tent inhabited by four men from *Senkor*, a well-to-do nomad with his servants. He had 700 sheep here and 300 at another place. His family and his large tent were at *Senkor*. He asserted that going S. 15° E., we would have only three days to the headquarters of the *Gertse* Pun or governor of *Gertse*. Going S. 40° E. we would come across tents from *Gertse* every day, provided that we would be able to find their dwelling places. His own tent was said to be the last from *Senkor*. The name of the place around *Camp CCCXLV*, was *Pankur*.

On *March 5th*, we covered 12.8 km. S. E. crossing the large plain which is a very flat basin. The first 5.4 km., we went down to the deepest point of the depression, being at 4,649 m. From this point the ground again rises to *Camp CCCXLVI*, at 4,704 m or 55 m. In the first case the rate is 1:55, in the latter 1:135. The minimum temperature was —16.8°. The morning was perfectly clear with sunshine and calm weather. At 8.30 o'clock a. m. the usual S. W. storm began, and within a few minutes, the whole landscape around again disappeared. On the way down to the lowest part of the depression, the ground is pierced by shallow erosion beds all of them containing snow. It will easily be understood how important it was for us to find snow nearly everywhere in these remote and dry regions of western Tibet. Sometimes we could march several days without finding open or frozen springs and if it had not been for the snow, our situation would sometimes have been rather critical. For the nomads this struggle for existence is easier. They are since generations familiar with the country and they know the location of every spring in the district they visit with their herds. From several nomads we heard that this winter, 1907—1908, was regarded as less cold than usual and more windy than other years. We had also found that the strong wind makes the temperature higher.

The shallow erosion beds we were crossing or following were directed to the lowest part of the depression where the fine silt brought down by the summer water, had formed a perfectly horizontal surface of yellowish clay. Here the last low hills to our right or west were left behind. As far as one could see, the country to the south appeared to be very flat and open. Here the plateau character is very pronounced. From the depression the ground slowly rises in the direction of a little low ridge where some snow had accumulated. Here *Camp CCCXLVI* was pitched, not far from a frozen spring, surrounded with poor grass and the usual plants. Nomads had dwelled here and had a sheepfold of stone.

The storm went on with enormous vehemence. It was as if a yellowish red or brown cover had been expanded over the whole country, consisting of these

billions of dust particles kept in suspension in the air and carried horizontally by the wind. When witnessing this procedure day by day from month to month and remembering that the same action has gone on since geological ages, one easily understands that the result can be but one, *viz.* the destruction of the relief of the whole country and the very far-gone denudation, the results of which meet our eyes everywhere, and which are so plainly visible on the long series of panoramas in my atlas. The student of physical geography who, in following my narrative day by day, has had the same patience as I had in performing the journey and sketching these panoramas in killing wind and bitter cold, will no doubt admit, that the panoramas give him a much clearer idea of the orographical morphology of Tibet than all the narratives of explorers put together. For no description in words can give so clear a conception of reality as a drawing or a photograph. But in this winter weather it was, as a rule, difficult to photograph, and, therefore, the panoramas and a few water colour sketches have to compensate a lack of the former.<sup>1</sup>

On *March 6th*, we marched 10 km. S. E. and S. S. E., sinking only 41 m. or to 4,663 m., being at a rate of 1:244. In the night the temperature went down to  $-23.6^{\circ}$ , and in the morning the air was absolutely clear and the sky as blue as turquoise. It should be noted that in spite of continual daily storms going on for weeks, the air after only one night's calm weather, becomes as clear and transparent as ever, allowing mountains at several days' distance to appear with perfectly sharp contour-lines and details. To a certain extent, this may depend upon the cold of the nights. After a severe storm in the region of *Lop-nor*, on the contrary, fine dust is kept in suspension for many days, and the air, even if perfectly calm, is so thick, that it would be impossible to tell where the sun has her place. At 9.15 o'clock a.m. the S. W. storm broke out. The dust clouds had a gloomy brownish red colour. The wind gusts occasionally blew down with such violence and force as to dig out furrows in the ground, like ploughshares. Sometimes spirals are seen in the ground which can only have been dug out by cyclonic winds. Whether the shallow holes of two or three meters in diameter also are a work of the wind or of some other agency I could not tell. The kyangs seem to love them, for there was always much dung of these animals in the holes. It is of course possible that the dung is blown thither by the wind.

Leaving *Camp CCCXLVI* which was also a well-known camping ground of the nomads, we crossed three small ridges, not more than about 20 m. above the camp. To our left is a little pool only a few hundred meters in length. It was frozen all over and the ice was covered with wind-driven dust. The pool would, therefore, never have been noticed if we had not examined the place. Two other

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<sup>1</sup> From *Camp CCCXLVI*, the short Pan. 427, Tab. 78, was drawn.



depressions of the same kind, though now without water, were passed. The living rock here about and in the small ridges, consists of grey, fine-grained granite.

In front of us and at the base of the mountains to the N. E. of our valley, we came in sight of a lake of moderate size. Beyond it, to the S. E. a farther range was visible at about two days' distance. The ground slowly falls to the lake, and is hard and easy for the march, consisting of fine gravel, somewhat undulated and traversed by shallow erosion furrows. There is some grass growing, and here and there, a small patch of snow is left. In the direction of our course, there is a black promontory from a ridge to the right or S. W. side of the main valley. To the S. W., the country seems to be very open for a considerable distance, and the ground here forms flat, long-stretched undulations. As we came down on the even plain of the lake, the S. W. wind began, and the landscape disappeared in a few minutes.

We approach the lake. Its western shore is striped in white and brownish red belts running S. W.—N. E., the former being salt deposits, the latter wind-driven dust. At some places the bluish green lake was open, the water thus being very salt. Along the S. W. shore, there is a belt of very good grass, one foot in height. This belt of vegetation is only about 200 m. broad and it has a sharp boundary to the nearly perfectly barren soil. At the foot of the black promontory, three camping places were seen, all of them with stone walls for the sheep. At *Camp CCCXLVII*, were also the remains of old camping grounds with fireplaces of stone. On Pan. 429A and B, Tab. 78, we see to the N. W. the running of the valley we had been following. To the north, N. E. and east, is the red mountain range bordering the lake at this side, and in the foreground is the lake itself.

In the afternoon the storm grew to the greatest violence I have witnessed. It must have been at least 30 m. a second. The temperature was unusually high,  $+2.1^{\circ}$  at 1 o'clock p. m. It would have been absolutely impossible to proceed against this storm, and a traveller who makes the attempt of crossing western Tibet to the S. W., will have to start at 3 or 4 o'clock in the morning. It is not only dust and sand, but also small stones that are carried away by the wind, and one has to protect the face from being badly whipped by them. Our men, fetching ice from the lake which was at a distance of 100 m., had to go with their back to the wind in returning to prevent being scourged by this hail of stones. As I have pointed out many times before in this narrative, we again got a very graphic illustration of the importance of the wind as an agency of transport and of the levelling of the country. After two winters in the *Chang-tang*, one has a perfectly clear understanding of the whole procedure. Such a storm as the one of March 6th, is a magnificent spectacle. After a sunny, bright and nearly calm morning, the day is changed into twilight, sometimes even darkness. Of the landscape, only the nearest part of the grazing ground was seen, even the shore disappeared, and above us and along the ground,

these heavy, dark, brown or reddish dust-clouds were swept to the N. E. Under such conditions every kind of work is impossible.

On *March 7th*, we made 13 km. to the S. E., rising from the 4,663 m. of the nameless lake, to 4,740 m. at *Camp CCCXLVIII*, or 77 m., being a rate of 1:169; figures that again show how very flat the gradients of the plateau basins are. The temperature of the night was at  $-15.0^{\circ}$ . The storm continued the whole night and the whole new day. After sunset, *March 6th*, the air became so much clearer that the upper parts of the nearest mountains were visible. In the night the strength of the wind was not quite as great as during the day. In the morning the air was sufficiently transparent to allow me to draw the last-mentioned panorama. The sky was over-clouded, though the clouds were not thick.

Leaving *Camp CCCXLVII*, the grass soon comes to an end and we traverse hard, barren ground with fine gravel, and flat undulations. The most characteristic feature of the shore region are the six well-developed terraces or beach-lines with flat rounded forms and depressions between them. This lake, therefore, is under the usual law of desiccation. At some distance from the shore, snow-patches were left here and there. Kyangs and *Pantholops* antelopes were seen in a few herds. We followed a path though we could not tell whether it was trodden by men or wild animals. As a rule, I believe that a single path is trodden by wild animals, whereas a road used by nomads consists of several paths parallel to one another, which is due to the fact that the sheep and tame yaks go in flock, not in single file. Just before 11 o'clock a. m., the storm grew to its full force and the mountains which at intervals had been in sight for two days, disappeared, and we were surrounded by darkness. We simply follow the path, and I read the compass. In the chaos surrounding us, we suddenly found ourselves at the edge of extended ice-sheets. We had to cross seven ice beds the broadest being about 100 m. across, and all at the same level as the ground around. The ice-bands came from N.  $52^{\circ}$  E and were directed to S.  $40^{\circ}$  W., obviously indicating a new tectonic valley of this rare direction. The broad belt of ice, clear as glass and disappearing to the N. E. and S. W., gave us the illusion of our standing on the bank of a large river. There was, however, no running water at all, and the ice-sheets had been accumulated in the usual way by a small brook. In the rainy season, the bed may, no doubt, carry a considerable volume of water. Only at one place was some open water, though not running. The bed proper, had minimal terraces, at the most, one foot high. On the other side a ridge of hills became dimly visible, and in the mouth of a little valley where grass and fuel were found, we made *Camp CCCXLVIII*. The storm ceased at midnight. The morning was windy, but the severe storm of the next day did not set in until 10.30 o'clock a. m. I could, therefore, draw the little panorama 430, Tab. 78, showing the contour-lines of the mountains to the west, north and N. E.

On *March 8th*, we followed the river down to the S.W. for 12.7 km., the ground falling 96 m. or to 4,644 m. which was the height of *Camp CCCXLIX*, the rate thus being at 1:132. The minimum temperature was  $-19.1^{\circ}$ . Another proof of the violence of these winter storms may be given. One of our mules had sprained her leg on the ice and had to be killed. Two of our dogs remained with the corpse at *Camp CCCXLVIII* when the caravan left, and were never heard of any more. It must indeed be very severe weather and a very strong corrosive power of the wind to make it impossible for dogs to scent the track of a caravan which they have been following so long.

On our route to the S.W., we had the ice bed to our right and the low hills to the left. In the latter, several small valleys open out, some of them with fans spreading down to the main river. At intervals there is no ice in the broad bed, which now has more marked side terraces though always low. Only twice we passed some little grass and once an old fireplace, the rest of the march the valley was barren. At the right or western side, the valley is bordered by hills of a reddish and violet colour. The distance from the river to the hills of the left side becomes greater. The valley turns to the south. Kyangs are seen at a few places. To the south the country is open, proving that the river continues in this direction. On the right side of the brook, we saw a large square stone wall with a gate from the east, inside of which, there was a house in the shape of a *gompa*, two or three stone huts, and a sheepfold. On a projecting rock with a perpendicular base, two *chortens* and a *mani* were built. Where we crossed the erosion bed of the valley its breadth was nearly 200 m. and in its middle it had some open spring water. *Camp CCCXLIX* was pitched at the lee side of the little hill with the *mani*. Some 400 m. S. E. of the camp, we saw through the dust haze a big black tent with white prayer rags on a pole, and a large wall. From this camp, Pan. 431A and B, Tab. 78, was drawn, showing the flat country to the north in the direction of the lake. To the N. E., east and S. S. E., are the mountains to the left side of the valley.

On *March 9th*, we stayed at *Nagrong*. The minimum temperature was at  $-19.0^{\circ}$ , but already at 7 o'clock a. m., we had  $-4.0^{\circ}$  and at 1 o'clock p. m.,  $+1.3^{\circ}$ . The weather was perfectly clear and cloudless, but already at 8 o'clock a. m. the strong wind began as usual.

The place was of a certain importance, being the residency of the Gertse Pun. This chief was now, fortunately, absent, and a Lama occupied his large tent. The latter told my men that we had a three days' journey southwards to the route which I had followed in 1901 and to the district called *Senkor*. The brook of *Nagrong* has, even in summer, very little water: only after heavy rains it becomes big. The ice-sheet would soon come to an end. On our route to the south we would have at least two days to the next tent, which, however, would be difficult to find. In

the seventh month, a fair used to be held at *Nagrong*, and at that time about 100 tents from the surrounding valleys used to come, as well as some merchants. In the region, there is then good grass for the herds. The nomads stay about a month, after which, and after having finished their bargain, they return to their valleys. At a short distance to the west of *Nagrong*, two tents were said to be pitched. The owners possessed some 700 sheep and used to wander to the fair of *Gyanima* every year. They would probably be able to sell sheep to us. I sent some of my men to the place, and the assertions of the Lama proved to be correct. My servants had wandered two hours and crossed a little pass beyond which they found a tent, the other being at some distance from it. The inhabitants were one man, one woman and four children. They had complained of the weather which, this year, was severer and more windy than usual, and the flocks had been suffering from it. Five sheep and two goats had been bought by my men. We, therefore, now had a caravan of 25 sheep carrying most of our luggage and provisions. If we continued S. E., we would come across some 10 or 20 tents of which they knew, but on my road from 1901 we would not find any nomads, as this region is inhabited only during the summer.

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## CHAPTER XXI.

### THE SURROUNDINGS OF TONGKA-TSO.

On *March 10th*, we covered 14.7 km. S. S. W. In this direction the valley of the *Nagrong* brook fell only 16 m. or to 4,628 m. at *Camp CCCL*, being a rate of only 1:919. The minimum temperature had been at  $-19.7^{\circ}$ , and the morning was perfectly clear and calm. We marched on the flat undulations on the right or western bank of the brook, pierced by several ravines and beds containing some snow. From here we now saw on the top of the little hill of *Camp CCCXLIX*, the two fine white *chortens* and two or three *manis*. On our way from the camp, we passed an extensive ice-sheet from a spring with some open water. Around it were several remains of camps, and such were seen at many other points in the valley, probably the encampments of the nomads coming to the fair.

The wind was blowing harder and at 11 o'clock a. m., the storm was again at its height. It is difficult to describe the gale that now began. We marched nearly S. W. and had the gale straight in the face. The ground descended in our direction, but, walking on foot, one had a feeling of going in three feet of water. The landscape that in the morning had been perfectly clear and sharp in the sunshine, was now completely effaced to our eyes. First dark yellowish red clouds of dust and sand were seen to the S. W., rolling, as it were, along the ground and gradually rising higher and higher and coming nearer and nearer. The sun disappeared completely, and the dust and sand clouds reached the zenith. All the surroundings disappeared. Only the very nearest patch of the ground was visible. But it soon became worse. We crossed the bed of the *Nagrong* brook, and approached the left or eastern side of the valley. Here the ground consisted of soft wind-driven sand which occasionally was arranged into small dunes, so low that it allowed the blades of grass to peep through. Here the whole ground seemed to move at an acute angle to our course. One's head turned giddy, and one had a feeling of suffocating. The pony refused to go on straight in the face of the sand storm. From time to time one has to stop and turn one's back to the wind. Half dead, one

finally reaches the foot of the hills at the left side of the valley and finds nothing except sand. After a while we found some snow buried under drift sand.

In the valley of *Nagrong*, we had thus witnessed a phenomenon that is very rare in Tibet, *viz.* the formation of sand dunes. The highest of them, only two or three feet, were situated near the base of the eastern mountains. I have already pointed out the surprising fact that sand dunes are extremely rare on the Tibetan plateau-land, though the conditions for their formation nearly everywhere seem to be existing, first of all the sand which continually is formed by destruction of the mountains, and then the regular wind with which I, during two winters, had become so intimately acquainted. To this comes the dryness of the climate and the want of vegetation, the whole country being not far from a perfect desert. And still one may wander for months through the *Chang-tang* plains and broad open valleys without seeing a single dune. This means, of course, that one or several conditions for the formation of dunes are not fulfilled. But on the eastern side of the lower part of the valley of *Nagrong*, there are none of the conditions missing, and the result is the belt of dunes we have crossed. There must, therefore, exist some important difference between the *Nagrong* valley and other valleys in Tibet. One great difference is that this valley runs N. N. E.—S. S. W. whilst most of the others run N. W.—S. E., W. N. W.—E. S. E. or W.—E. But this is not sufficient for explaining the existence of dunes as I have seen other meridional valleys, for instance between *Targo-gangri* and *Shuru-tso*, where no dunes have accumulated. Perhaps the relative height of the hills and ridges on both sides of the *Nagrong* valley plays an important part. Perhaps also the absolute altitude and the rarefaction of the air have something to do with the problem. Thus, for instance, there is to the east and S. E. of *Kumi-köl*, south of the *Kalta-alaghan* Mountains in northern Tibet a sand desert with considerable dunes, along which I travelled in 1900, but there the absolute altitude is only 3,900 m. In the *Tsangpo* valley in 1907 I also passed through regions of sand dunes, *viz.* east of *Karu* at a height of about 4,000 m. and at *Dongbo, Camp CLXXXIX*, at a height of not quite 4,600 m. as described in Vol. II, p. 294 and 323. In both these instances the valleys containing the sand dunes are running from west to east and are large latitudinal valleys. As we have seen many latitudinal valleys in Northern and Central Tibet which have no dunes at all, and as the *Nagrong* valley, which is rather meridional has dunes whilst other meridional valleys have none, the direction of the valleys seems to play a subordinate part. The valley of the *Tsangpo* should, perhaps, not be directly compared with the valleys of the *Chang-tang*, as its sands are brought down by the river and not by the wind. But in the other valleys mentioned, the same conditions are prevailing. Now as regards the *Nagrong* valley, we have found that its absolute altitude was lower than the whole country we had travelled through ever since December 17th,

or *Camp CCLXXXI*. The absolute altitude, therefore, seems to be of very great importance in connection with the formation of dunes.

But another reason also seems to have to be taken into consideration, for otherwise it would be difficult to understand why there are no sand dunes in the valley between *Targo-gangri* and *Shuru-tso*, though the altitude there is not much higher than in the *Nagrong* valley, or about 4,750 m. I cannot tell what this reason is. But I believe that it depends upon the morphology of the country itself, the relative height of the bordering ranges above the floor of the valley, the breadth of the valley in relation to the height of its border-ranges, the steepness of the slopes, the quality of the western range as a former of a lee side and the surface form of the ground of the valley. Only when *all* these conditions are fulfilled, as obviously in the *Nagrong* valley, sand dunes may and *must* be accumulated.

I have said before, that *Camp CCCXLIX* had a height of 4,644 m. and *Camp CCCL*, one of 4,628 m. It should, however, be remembered that from the point where we crossed the brook of the valley, the ground rises towards the base of the hills at the last-mentioned camp. The height of the bed just west of this camp was, therefore, much less than 4,628 m., probably only 4,550 m. The eastern half of the *Nagrong* valley, therefore, certainly rises some 80 m., from the brook to the base of the hills. In other words, the slope of the floor of the valley is such as must be favourable for the formation of sand dunes.

The next day's march we had to ride amongst dunes only for 2 km., after which they became rudimentary and soon ceased altogether. The belt of sand dunes, therefore, had a length of some 6 or 7 km. and a breadth of about 1 km. Only on this little surface and nowhere outside of it, all the conditions were existent. Now when one sees the enormous masses of sand and dust that are carried by the wind up through the valley, — how a little bag in which one of my men carried the aneroids, thermometers, sketch-book and other things, was half filled with sand at our arrival at camp, — and how tents, blankets, clothing, boxes, everything, became heavy with sand, one easily realises that these sand dunes would, in the course of many years, rise to an enormous height, if there was not an agency that made their farther growth impossible. This agency is the strength of the wind itself. The dunes of *Nagrong* have already reached their maximum height. All the sand that is heaped on them by the wind nearly every day is immediately carried away from the dunes by the same wind. The belt of dunes is only a station on the way of the drifting sand. If occasionally, during a day with moderate wind, the dunes grow in height, they will again be beaten down to their normal height by the next hard storm.

The fact that the storms do not sweep away *all* the sand of *Nagrong*, only proves that the gradients of the slope and the altitude and form of the western

mountains afford a lee side sufficient for the small dunes to remain at their place. It may be that the height and shape of the dunes are changed during other seasons when the winds are less strong or coming from other directions. But in the winter the surplus of sand will again be carried away and the dunes return to their normal size. In the latitudinal valley I travelled through in 1896 and in the one of 1906, no dunes had been formed because all conditions were not existent, and the existence of sand and wind alone, is not sufficient for the formation of dunes. In how far and why the absolute altitude plays a part, I cannot tell, but, as I have mentioned above, it is noteworthy that the sand belts are only to be found at a comparatively moderate height, and that there are no dunes at all on the highest regions of the Tibetan plateau-land.

There is another interesting problem to be considered in connection with this question. The destruction of the mountains goes on irresistibly. The peaks, ridges and ranges, therefore, become lower and lower, a fact that is by no means influenced by the slowness of the procedure. The hills west of the *Nagrong* dunes will, one day, become so low that there is not lee side enough for the dunes, and the particles of drift sand will no more find a station along the base of the eastern hills. It is probable that this state of things has already entered in several Tibetan valleys where, at an earlier period, dunes have existed. But, on the other hand, it is not likely that there have been extensive sand deserts in the great latitudinal valleys in post-glacial time. The greater precipitation, which now is going towards desiccation, would not have allowed the formation of dunes. The dryness of the air is an important factor in all sand deserts. As now, during the present epoch, the air is becoming more and more dry, is it then likely that the Tibetan highlands are at the beginning of a period more adapted to the formation of sand deserts? This is not probable as long as the winter storms sweep across the country with their enormous force. In those parts of the *Lop* Desert and the desert of *Seistan* in *Persia* where the regular wind is at its strongest, there are no sand dunes. But in other parts in the neighbourhood, where the wind is more moderate, dunes of enormous height are formed, as to the west of the lower *Tarim* River. Here, therefore, it is obvious that if the wind surpasses a certain degree of velocity, no dunes may be formed, even if all other conditions are satisfied. This is the case in Tibet: the wind is too strong. Dunes that are formed at seasons are again swept away by the storms.

On *March 11th*, our route is 8.6 km. south, a little to the east. The ground falls 97 m. or at a rate of 1:88. The minimum temperature was at  $-16.6^{\circ}$ . In the morning the wind was moderate, but at 10.40 o'clock a. m., the usual storm began with full strength and continued the whole day. In the evening, again, the wind was not strong. Before the storm began, the landscape became visible and its principal features could be inserted on the map.



We travelled amongst small dunes to the S. S. W. along the base of the hills which here and there are pierced by transverse valleys. In the mouths of some of them, the dunes were somewhat higher than on the floor of the valley. In the middle of the latter, two small isolated hills were seen. To the west the country is bordered by low hills. So far as may be seen, the *Nagrong* brook turns S. S. W. Whether it goes to a little lake to our right or continues to some other depression amongst or beyond the low western hills, could not be made out. Our route then turns S. S. E. and we cross a larger tributary from the eastern hills, in which there is some snow and drift sand. Very often the snow is buried under fresh sand, which one notices only when the pony sinks through. At the base of a third little detached hill were two sheepfolds and remains of camps. Beyond it, the ground of the plain consisted of gravel and soft sand with grass, but no dunes. Between the little lake or pool and the eastern hills, we made *Camp CCCLI*, where the grass was good, dung of kyangs and snow in abundance. Here, Pan. 432A and B, Tab. 79, was sketched, showing the ridges to the west and N. W. across which the drift sand is brought by the wind.

On *March 12th*, the direction of the valley changes our route to E. S. E. We had 10.4 km. to *Camp CCCLII*, where the height was 4,568 m. or 37 m. above the previous camp. The ground was thus again rising at a rate of only 1:281. The little lake of *Camp CCCLI* is, therefore, the lowest part of the basin of the *Nagrong* valley. The minimum temperature of the night was  $-14.0^{\circ}$ . Already at 6 o'clock a. m. the wind was very strong, but the usual storm, with sand dust and darkness, began at 10.15 o'clock a. m. From *Camp CCCLI*, the little lake was seen to the N.  $48-88^{\circ}$  W., at a distance of about 1 km. It had no open water, nor could ice be seen, as it appeared brownish yellow, nor whether it was its naked bed or dust on the ice. No doubt it contains water in the summer. To the E. S. E., we now had a large open latitudinal valley with slightly undulated ground. It would have been impossible to tell in what direction the floor of this valley fell. But as the erosion furrow of *Camp CCCLII* seemed to turn eastwards, we probably crossed a very flat and imperceptible water-parting somewhere before this camp.

The hills on both sides are rather low. The southern are the higher and have a good deal of snow on their slopes. The soil consisted of hard, fine gravel with some grass. Some parts are barren. There is very little sand and no dunes. Traces of nomads were not seen until reaching the camp, where tents had been pitched. Large herds of kyangs grazed on the plains, one of them numbering 74 individuals. As a rule, we had found that kyangs were rare in the northern parts of *Chang-tang* during the winter and became more and more common in the parts we now had reached. The yaks were rarer here than farther north. The *Pantholops* antelopes had been seen in greater numbers in the northern regions and seemed to be quite insensible to the cold.

*Camp CCCLII* was pitched in an erosion bed just below its western terrace of red clay. The bed was directed to the N. N. E. and then seemed to turn eastwards. It contained snow. The grass was good and fuel abundant. On *March 13th*, we stayed. The temperature was at  $-12.8^{\circ}$ . It had snowed the whole night and still snowed at 8.30 o'clock a. m. The whole country was quite white and nothing could be seen of the surroundings. The wind suddenly ceased in the evening, *March 12th*, and the night was calm. During the 13th, the clouds were extremely thick, but at 9 o'clock p. m., the weather was absolutely clear again. The wind was not strong and no storm came. The next night the minimum temperature was  $-24.0^{\circ}$ , and *March 14th* began with an easterly wind, which at noon turned to S. W. and in the evening became strong. The snow lay rather thick everywhere in the morning of the 13th. In the course of the day, a part of it disappeared. In the morning of *March 14th*, only half the ground was snow-covered and at noon, only one tenth. But the sun was visible in spite of small white clouds here and there. On account of the very dry air, the snow very quickly evaporates.

Our progress, *March 14th*, took us 11.6 km. E. S. E., the ground was falling eastwards 34 m. or to the 4,534 m. of *Camp CCCLIII*, being at a rate of 1:341. We had, therefore, really crossed a water-parting west of *Camp CCCLII*.

As soon as we had left our erosion bed and come out on more open ground, the view to the E. S. E. through this latitudinal valley was open for several days, and only far away, low hills were visible above the horizon. It was still impossible to tell in what direction this valley fell, but it seemed to be eastwards, as all transverse furrows we crossed, turned about N.  $30^{\circ}$  E. We, therefore, had the bed of the chief watercourse of the valley to our left at a distance of 1 or 2 km. and it seemed to be broad and shallow. There is a very large number of small tributaries from the southern hills. All of them contained snow along their western terraces. The hills to the right or south are of moderate size. They are snow-covered, whereas the northern hills are bare. The latter are higher and are also traversed by many small valleys. The principal bed goes nearer to the northern side of the valley. The floor of the latter is slightly undulated. Its breadth is some 15 km. The ground is comfortable for the march. The grass becomes meager to the east. We followed no road. Antelopes and hares were numerous. Near *Camp CCCLIII*, we met three shepherds driving some 400 sheep westwards to a place called *Takgom* at a day's distance. A valley with surrounding mountains to the N. E., was called *Kung-takar*, where a tent was situated. A projecting hill farther east, belonging to the northern range they called *Kung-tsakma*. Eastwards, we were said to have one day's march to a large lake called *Tong-tso* or *Tongka-tso*.

Pan. 433A, B and C, Tab. 79, gives an idea of the view around this camp. S.  $63^{\circ}$  E. begins the base of the southern hills, which continue all the way, past

south, to S.  $77^{\circ}$  W. Then follows the profile of the latitudinal valley like a straight line to N.  $77^{\circ}$  W., and the rest of the panorama past north to N.  $85^{\circ}$  E., *Kung-tsakma*, represents the northern range. Between N.  $85^{\circ}$  E. and S.  $63^{\circ}$  E. is again a straight line indicating the open perspective of the latitudinal valley.

On *March 15th*, we made 16.3 km. E. S. E. The ground falls in the same direction, though only 23 m. or to 4,511 m., which is the height of *Camp CCCLIV*. The rate is, therefore, extremely slow or as 1:709. The minimum temperature was  $-19.9^{\circ}$ . In the morning a light breeze came from the east but turned around to S. W., though not hard. The sky was overclouded from noon.

As usual in a latitudinal valley, the march was extremely monotonous. The northern and southern mountains had the same features as the day before, and seemed to continue very far to the east. As my intention was to cut the *Transhimalaya* System in its most unknown portion between my routes of the previous year, we had to cross, as soon as possible, the southern mountains of the latitudinal valley. Therefore, we marched at no great distance from their base, crossing a large number of small transverse erosion beds, nearly always containing some snow. The rest of the ground was bare. Only in a larger bed, Tibetans had camped. The ground was hard and comfortable, consisting of fine gravel; the grass became more and more scanty to the east.

At 2 or 3 km. north of our course, the floor of the valley seemed to be perfectly level and consisting of red clay with some white patches of salt crystallizations, indicating a greater extension of the lake at an earlier period. The clay bed continues to the very shore of the lake. In the latter part of the day's march, we crossed a very flat protuberance, being the slope of the scree at the base of the southern mountains we had near our right. This slope was cut through by innumerable erosion furrows about 2 m. broad and 1.5 or 2 m. deep, and often with overhanging terraces. They formed real nets of branches, joining and going down to the red clay surface. Reaching the culmination point of this protuberance, we became aware of the lake, *Tongka-tso*, a white surface, whether ice or snow, could not be made out. In the middle there seemed, however, to be open water. Far to the east, the bordering mountains of the latitudinal valley seemed to join like a *cul de sac* which must have been an optical illusion as, according to Nain Sing in 1874, the lake *Tashi-bup-tso* is situated in this latitudinal valley and east of *Tongka-tso* with which it probably is in communication. The illusion is obviously caused by the fact that the valley from *Tongka-tso* and eastwards assumes a more easterly direction in accordance with the general orographical rule of the Tibetan highland. Kyangs and antelopes were grazing in the valley. *Camp CCCLIV* was pitched in a shallow bed containing some snow and with scanty grass in the surroundings. The dung of kyangs was the only fuel to be had.

The landscape visible from this camp, is shown as Pan. 434A, B and C, Tab. 79. To the W. N. W. the horizon is formed by a straight line very slowly sloping from the base of the southern to the base of the northern mountains, being the more developed scree of the former and explaining the fact that the principal erosion furrow and the bed of red clay are situated nearer to the base of the northern hills. N. W., north, N. E. and E. N. E. is the considerable range of mountains bordering the valley to the north. Eastwards is the prolongation of the latter, containing *Tongka-tso*, and at a greater distance, the mountains closing the view in this direction. The rest of the panorama the whole way to the W. S. W., shows the southern mountains. To the S. 40° E., was a conical snow-covered peak, higher than all other mountains in sight.

On *March 16th*, we travelled 7.6 km. S. E. at a distance of 2 or 3 km. from the shore. *Camp CCCLV* had a height of 4,507 m., about the same as the previous camp. The temperature was down at -18.9°. The wind continued the whole night. At 6 o'clock a. m. it was nearly calm. The sky was thickly overclouded the whole day. At 8 o'clock a. m. the S. W. wind began again, not very strong. White clouds of salt dust were whirling on the shores of the lake.

We marched across the plain in the direction of the mountains, where, south of the lake, a large valley seemed to open from the south. The ground consists of hard gravel and is nearly barren. We cross a series of these deep-cut small furrows which contain snow and are a hindrance to our progress. Their terraces are, as a rule, vertical and in them one sees the stratification of the filling of the latitudinal valley, consisting of coarse sand and fine gravel. In a ravine 10 m. broad and 3.5 m. deep, we pitched *Camp CCCLV*. In this bed we found snow, fuel and some wind-driven grass. Kyangs and antelopes were numerous in the region and one wolf was seen. Not far from the camp, two tents were pitched, inhabited by two men, one woman and a child. They said they came from *Nakchu*. They called the region *Tongka*, and the lake, *Tongka-tso*. Three different roads were said to lead from here to the *Serpun lam* or »Road of the gold-chief«, which is about the same as the one followed by Littledale in 1895 and by me in 1901. Marching S. W., one could reach this road in three days; to the S. E. it would take 6 or 7 days and only once tents would be found. To the east they reckoned 15 days to a region called *Seleb* on the road to *Nakchu*. To the boundary of *Naktsang*, they reckoned 18 days.

Pan. 435A, B and C, Tab. 80, taken from *Camp CCCLV*, completes the impression given by the one from the previous camp. It shows the northern mountains, the lake, the distant hills bordering the lake to the east, and the southern ranges, at the very base of which the camp was pitched. To the S. 47° E. is the entrance of the valley by which we turned south.

*March 17th*, we travelled 10.4 km. S. E. along the base of the hills, to *Camp CCCLVI*, 4,505 m. high or 2 m. below the previous camp. The minimum temperature was at  $-13.2^{\circ}$ , the clouds were light as a haze. A fresh S. W. wind was blowing at noon.

First we crossed the plain of the lake, situated perhaps 10 m. above its surface. From here, two or three patches of open water were visible. According to the nomads, a lake situated east of *Tongka-tso*, was called *Tong-tsaka*; the latter could not be seen from our route. Then we had to march across the flat slopes from the hills to our right, and from the last of these a plain again appeared. Several deep-cut beds lay across our road. A herd of the little *Gazella* antelopes was seen. In a valley to our right, there was a tent. The second plain which also was cut through by numerous ravines, is, as the first, in connection with the even land surrounding the lake.

*Camp CCCLVI* was pitched in a ravine near the base of the hills, containing snow which now began to be rare. Pan. 437<sup>A</sup> and B, Tab. 80, taken from this camp, give a good perspective view of the country. To the south, west, and W. N. W., are some of the hills in our neighbourhood. The hill N.  $75^{\circ}$  W., still belongs to the southern mountains of the latitudinal valley, but the hill N.  $53^{\circ}$  W. belongs to the northern. Between these two, therefore, is the even floor of the latitudinal valley. At about N.  $30^{\circ}$  W., is the western end of the lake, and beyond it the northern mountains. Eastwards the view is hidden by a detached hill in our vicinity.

A poor Tibetan and two children who had their tent not far S. E. of our camp, gave us the following information. The snowy mountain visible to the S.  $40^{\circ}$  E. on Pan. 434<sup>C</sup>, Tab. 19, they called *Yä-gangri*. The region of *Camp CCCLVI* was called *Ganpo-gatlé*. The whole district from here to the south, was *Bongba-changma*, the northern district of the province of *Bongba*. The road we were to follow during the next few days, was called *Yuntso-chaklam*, which indeed was correct, as we later on crossed a pass called *Yuntso-la* and another called *Chaklam-la*. We also would have to cross a river with the name of *Sangchen-gi-chu*, which was in accordance with a third pass, *Sangchen-la*. During the next three marches, we would, very likely, come across 3 or 5 tents, the flocks of sheep of which had suffered very much from the severe winter. The nomads of this region also complained of the bitter cold and the strong winds of this winter. As to *Serleb*, obviously the same as the above-mentioned *Seleb*, they said it was the name of the district eastwards. They knew of the district *Tang-yung* which was very mountainous and stony and where there were no nomads.

## CHAPTER XXII.

### THE REGION WEST OF SHA-KANGSHAM.

Our last three camps had been situated on the shore plain of *Tongka-tso*. *March 18th*, we left it and began to ascend south-westwards towards the pass of the first latitudinal range bordering the valley of *Tongka-tso* on the south. The distance accomplished was only 7.8 km., but on this stretch we ascended from 4,505 m. to 4,773 m., or 268 m., being a rate of 1:29. The temperature of the night was low or  $-26.7^{\circ}$ ; in the morning, the weather was good and clear and the S. W. wind in the course of the day, not strong.

Just S. E. of the camp, we had to cross a little threshold in the red hills of soft material, beyond which we turned S. W. up through the valley of the pass. At the left side of the latter, there was a tent, and higher up some 15 yaks were grazing. The nomads complained that the severe winter had killed many of their sheep. A second tent with a large sheepfold of stone, was passed. We made our *Camp CCCLVII* in the valley. Here the living rock was green quartzite. Pan. 436, Tab. 80, embraces only the part of the horizon where the view was free. The high snow-mountain to the S.  $48^{\circ}$  E., proved to be *Sha-kangsham*, the mighty massif I had passed in 1901, and which, after a few days, would become better visible.

On *March 19th*, we made 8.2 km. in a zigzag route to the south, rising 117 m. or to the 4,890 m. of *Camp CCCLVIII*. Between the two camps, there is, however, a pass of 4,918 m. From *Camp CCCLVII*, it is at a distance of only 2.2 km. S. S. W., and the rise to it is 145 m., the rate of the rise up to the threshold, therefore, being as 1:15, which is rather steep. On the other side we first go down S. E. some 150 m. to the lowest part of the valley in which we then ascend in the direction of the next pass. The Tibetans asserted that there was another pass across the range situated at some distance farther east, but it was said to be higher and more difficult than the one we crossed this day. The ridge we had to cross was, no doubt, a secondary ramification from the range south of *Tongka-tso*, and to our eyes, this ridge seemed to be easier towards the east.

A little path went up to the threshold of 4,918 m., where the living rock consisted of greyish pink half crystalline limestone, cropping out here and there amongst the débris. To the north, or N. N. E., we had a mountain massif on both sides of which small parts of *Tongka-tso* were visible through valleys or low parts between the hills. The eastern one was directed to the N. 23° E. From this high standpoint, the greater part of the lake seemed to be dry. South of the threshold, a broad valley goes down to the S. 72° E., joining the valley which comes from the next pass. Where the joint valley goes to could not be made out from here, but it is most likely that it still belongs to the depression of *Tongka-tso*. To the west the first-mentioned valley comes from comparatively higher mountains. At its southern side, W. S. W. from the pass, there was a tent and several yaks. Marching S. E., we crossed the valley diagonally. At the eastern side of a little hill, to the left of our route, three tents were pitched and 8 ponies grazing; higher up a flock of yaks was seen. Near the tents we turned S. W. up through the second valley which was narrower and seemed to be a tributary of the first. A Tibetan we met pointed out the direction up to the next pass, *Yum-tso-la*, on the other side of which there was a little lake called *Yum-tso*, in the vicinity of which a Tibetan camp was to be found. If we travelled E. S. E. from this lake, we could come across many tents, but going south we could only once find nomads, *viz.*, in 4 or 5 days, the headquarters of the Bombo of *Bongba*.

At the right side of the valley is a frozen spring. On a slope a shepherd with 300 sheep, was climbing. We had reached a region inhabited by several nomads. It was asserted that *Bongba-changma* numbered 300 tents. The chief or Bombo lived in the centre of his district, and his subjects were spread in the valleys around. As snow was rare, we camped at a place where the grass was good, and some snow left. From *Camp CCCLVIII*, Pan. 438, Tab. 80, was sketched. To the S. 6° W., the valley is seen going up to the pass, *Yum-tso-la*, to the west and north is a more rounded mountain group, and to the N. 40° E., is the valley by which we have ascended and which goes down to the *Tongka-tso* depression.

On *March 20th*, we wandered 9.6 km. south. The distance from the camp to *Yum-tso-la* was 1.2 km. and the ascent 65 m., the rate being as 1:18.5. From the pass to *Camp CCCLIX*, or rather the little pool of this camp, the distance was 8.4 km. and the descent 191 m., the rate being 1:44. *Camp CCCLIX*, at 4,768 m., was only 4 m. above this pool. The weather was fine and clear and the minimum temperature of the night only —14.8°. The S. W. wind had dwindled to a light breeze.

The pass was easy, the saddle being a broad and open platform. Its altitude was 4,955 m. The name given us in this very region, was *Yum-tso-la*, though other nomads pretended that the pass of this name was situated farther south. To the W. S. W. on a slope, five tents were seen, all at one place. A little lake fills the

flat depression just south of the pass, though its ice-sheet seemed to be formed from springs, to a large extent, and perhaps the »lake« disappears in summer. The path down from the pass, is very steep, so much so, that one prefers to walk on foot. The path leads down to a new latitudinal valley, which, however, is half closed both to the east and west. *Sha-kangsham* now becomes visible in all its magnificence with eternal snow-fields and glaciers. At the northern edge of the *Yum-tso* depression, a spring of beautiful fresh water of  $+1.4^{\circ}$  is bubbling up in a hole half a meter across in the sandy ground which, around the hole, was frozen to a depth of 15 cm. The spring forms a minimal brook which goes to the depression and feeds the ice-sheet. The path leads along the eastern shore of the ice, where the shells of small mollusks, especially *Planorbis*, are very numerous. On the slopes around, old camping places were to be seen everywhere, and to our left, a large flock of sheep was grazing. To our right a big tent was pitched. The ground then becomes undulated, and here and there, snow patches are left. Beyond the undulated ground, we go down to the very flat valley of a river, which was mostly open, and partly covered with thick ice. Its bed was very broad and shallow. To the south it is bounded by red hills. At its northern side, where we pitched our *Camp CCCLIX*, 4,768 m., was an ice-sheet, resembling a pool, but probably only formed by spring water.

To the N. E. and S. E. of the camp, two tents were seen. In the large tent west of our route, only women and children were at home. The men were absent with the yaks. The information given here did not agree with what we had been told before. The real *Yum-tso-la* was said to be a pass we had to cross the next day, and the lake they called *Shar-tso*. It is impossible to tell which information is correct. The considerable snowy mountain to the E. S. E., they called *Ya-kangsham-gangri*, though *Sha-kangsham* seems to be more correct. It is visible to the S.  $64^{\circ}$  E., on Pan. 439A, Tab. 81, and on the water colour sketch on the opposite page. The snow-fields and *névés* are not continuous, for the black rock is visible even at the very top of the massif. Properly, it forms a short ridge with five culminating peaks becoming higher towards the south. In the valleys or troughs between the ridges starting from the peaks, the *névés* and rudimentary glaciers are situated. Pan. 439A and B, gives the perspective of the range of rounded reddish hills to the S. E., south, S. W. and west, standing south of the river at our camp which was called *Kangsham-tsangpo*. It seems to come from a valley about S.  $60^{\circ}$  E., and it flows N.  $70^{\circ}$  W., where, on the panorama, the continuation of its valley is visible. The latter half of the same panorama gives an idea of the range we had crossed the same day.

On my journey in 1901, I passed N. E. and north of *Sha-kangsham* (Schahgandschum as I spelled it then). From the road between my *Camps CII* and *CIII*, October 11th., I took bearings to its different peaks, as may be seen on Pl. 67, Vol. II of the Atlas of my »*Scientific Results of a Journey in Central Asia 1899—1902*«.



VOL IV

S 64° E



S. H.

THE SHAKANGS-AM FROM CAMP 309

S 73° E



S. H.

THE SHAKANGS-AM FROM CAMP 360



From the same camps, I took small panoramic sketches of the group to the S. W. and W. S. W. from *Camp CII* and to the S. S. E., south and S. S. W. from *Camp CIII*, as will be seen on Pl. 21 in Vol. IV of the work mentioned, p. 142. P. 139 *et seq.*, in the same volume, I give a description of the *Sha-kangsham* as I saw it from the east and north in 1901. Both descriptions agree very well and show that the group has exactly the same features and configuration on both sides. The identification of *Sha-kangsham* was very valuable as a means of connecting and checking my maps of 1901 and 1908. The route of 1901, has no doubt been crossed by the route of 1908 just north of the pass, *Yum-tso-la*. *Camp CV* of 1901, 4,812 m. high, was obviously situated somewhere in the neighbourhood of the three Tibetan tents between *Camps CCCLII* and *CCCLIII* of 1908, where the two above-mentioned valleys met and went to *Tongka-tso*. Near *Camp CV* of 1901, there is also a bearing N. 10° E. to a lake, and from *Camp CII* there is a bearing N. 60° E. to the same lake, the latter no doubt being *Tongka-tso*. In accordance with these facts, Colonel Byström has also plotted this region on the map of 1:1,000,000, sheet *AV*. Just north of *Sha-kangsham* I entered in 1901, the same road which Littledale had taken in 1895. He also mentions the mighty snow massif and gives it the correct name. From this point, where I crossed the road of Littledale and myself, I had now absolutely unknown country to the south for 270 km. as the crow flies, down to the route of Ryder in 1904, in the *Tsangpo* valley.

On *March 21st*, we made 7.4 km. S. S. E. In these regions, our marches were very short. Our little caravan consisted of sheep and yaks, both going very slowly, and accustomed to short marches; our last mules and ponies were quite worn out. From the camp on *Kangsham-tsangpo*, we had 4 km. to the next pass, situated in a little latitudinal range which we had to cross. *Camp CCCLIX* was at 4,768 m., and the pass had an altitude of 4,972 m., the rise thus being 204 m. and the rate being as 1:20. From the pass, we had 3.4 km. to *Camp CCCLX*, where the height is 4,882 m., or a fall of 90 m., the rate being as 1:38. The minimum temperature of the night was -18.0°. The new day, the weather was good.

The river, *Kangsham-tsangpo*, was divided into several large and small branches. Around the open water, which could be about 2 or 3 cub. m. per second, the ice was thin and the animals broke through. The river obviously comes from the snows, rudimentary glaciers and springs of *Sha-kangsham*, as is also indicated by its name. I have no doubt that this river goes out into the *Lakor-tso* at its southern shore, the distance being only 57 km. My *Camp CVIII* of 1901, is situated on a river which my Tibetan escort called *Some-tsangpo*. For one day I followed the river downwards to its mouth in the lake. As our *Camp CCCLIX* of 1908 had a height of 4,768 m., whereas *Lakor-tso* has only 4,600 m., this also is in accordance with my assumption. On October 19th, 1901, the river carried, at 10 o'clock a. m., only

1 cub. m. per second, but, in the afternoon 3 cub. m. (*Scientific Results*, Vol. IV, p. 160). It may be regarded as pretty certain that the river, which in the summer may be rather strong, judging from the fluvial terraces, loses a good deal of its volume on its way from *Sha-kangsham* down to *Lakor-tso*.

Having crossed the river, we turn S. E. along the base of the red hills, where the living rock is grey, dense limestone, the same kind as I had found N. E. of *Sha-kangsham* in 1901. A little, steep valley leads us up to the pass of 4,972 m., in the hills of soft material. From here a range comes into sight, which starts from *Sha-kangsham* and seems to run westwards and which we would have to cross farther south. Between that range and the one of our present pass, there was a plain. To the S. W. two tents were pitched. It may be that we could have avoided this pass by following the *Kangsham-tsangpo* upwards some kilometers, for now we got the impression that the river crossed the N. E. part of the plain. We descend amongst hills sometimes up and down, and pitch our *Camp CCCLX* at the southern side of a little hill. From the pass, a valley goes down E. S. E. and may perhaps join the river.

From this camp, Pan. 440A and B, Tab. 81, is sketched. It shows the range we crossed, and to the east, the prolongation of the plain which probably is traversed by the *Kangsham-tsangpo*. To the S. 73° E., is again the highest peak of *Sha-kangsham*, and around it and to the right of it, a labyrinth of ranges and ridges, being more or less in connection with the great snowy group. The plain east and south of our camp, belongs to the latitudinal valley situated north of *Sha-kangsham*. Its eastern part is, as is shown to the N. 88° E., on Pan. 440A, quite closed by mountains.

The two tents S. W. of the pass, were inhabited by a man, three women and three children, possessing 200 sheep. The latter were weak and meager, as they had, one month ago, returned from a journey south, to *Kirong*. The nomads asserted that the region around *Camp CCCLX*, was called *Kombak*. From this place, roads were radiating in different directions. If we went to the S. E. and E. S. E., passing a dark projecting hill visible from our camp, we would, after having crossed a high pass, finally reach *Chokchu*. Now, as there is a province of that name between *Dangra-yum-tso* and *Teri-nam-tso*, which is indeed E. S. E. of *Kombak*, the information was obviously correct. We were also told that it was a three days' journey W. S. W. to the tent of a chief, and that a high pass had to be crossed. If we continued S. S. E., we would reach, in one day, a pass called *Chaklam-la*, the entrance of which is visible on Pan. 440. Taking the last-mentioned road, we would leave to the west both the chief's tent and the lake, *Yum-tso*. As we heard different nomads mentioning this lake, it, no doubt, exists, though it is probably somewhere west of our road. The name *Yum-tso-la*, therefore, seems doubtful, as its single *raison d'être*

would be the vicinity to the lake. The nomads here pronounced the name of the great snow group, *Sha-kangsham*. A water colour view of it is shown on an accompanying page.

On *March 22nd*, we travelled 8 km. S. S. E., rising from 4,882 m. to 5,029 m. or 147 m., being at a rate of 1:54. The minimum temperature of the night was  $-15.1^{\circ}$ . The weather was favourable. We travelled across even, hard ground leaving to our left, the little isolated hill at which we had camped. Here a woman was watching sheep and 11 yaks. Now, to the E. N. E., the prolongation of the latitudinal valley opens up, and in it extensive ice-sheets are seen, obviously the *Kangsham-tsangpo*, which, therefore, seems to pierce through the range we had passed last. To our right is a mountain with a very sharp edge, visible on Pan. 440, and situated at the left side of the entrance of the valley we had to follow to *Chaklam-la*. We follow along the base of these hills across gravelly, disagreeable ground.

*Camp CCCLXI* was pitched at a spring with fresh, open water forming ice-sheets. From here, *Sha-kangsham* was mostly or largely hidden by nearer ridges and the rest of it also disappeared in thick clouds. The inhabitants of a tent close by, said the region was called *Amchen* and the pass in front of us, *Amchen-la* or *Chaklam-la*. The river south of it, they called *Sangchen-di-chu*. The next five days before us, were said to be difficult as we had to cross several passes. The nomads here had only some 80 or 90 sheep, but the inhabitants of two tents to the S. E., possessed 800. Two men, two women and a child were living in these tents. The party had arrived from the south a short time ago. The governor, Karma Puntso, was said to live in a region to the west called *Pombok*. To *Kirong*, they reckoned 40 or 50 days *via Samokul*. *Chokchu* could be reached in 8 days eastwards. The governor was a certain Ganchen Sonam Dorche, though the man I met in *Selipuk* later on and who presented himself as governor of *Chokchu* had the name, Sonam Ngurbu. Tsongpun Tashi was said to be a great merchant from *Lhasa*, dwelling 7 days south on the *Serpun lam* or gold-chief's road, which is, therefore, far to the south of my road of 1901. Ten days south of his residence, we would find 8 or 9 tents in a region called *Sherma-denang*. Continuing south we would have 5 or 6 days to *Kemar-denang*. Thence 5 days to a pass called *Pota-la*; thence 3 or 4 days to the pass *Samyas-la*; thence 2 days to *Rukyok*, and thence 4 days to *Saka-dsong*. Nearly all this information was correct.

At *Camp CCCLXI*, the living rock consisted of grey, dense limestone which prevails in the whole region. From this camp, Pan. 442, Tab. 81, was drawn, embracing so much of the landscape as could be seen, for the rest was hidden by the hills at the base of which we camped. To the N. E. it allows a peep into the latitudinal valley in which the *Kangsham-tsangpo* flows. The greater part of the *Sha-kangsham* is hidden by different ridges and hills, but its highest peak is seen to the S.  $81^{\circ}$  E.

To the S. E. and south, are parts of the range we had to cross in *Chaklam-la* the next day.

On *March 23rd*, we travelled 8.7 km. S. S. W. and S. W. From *Camp CCCLXI*, we had to rise 256 m. to the 3.4 km. distant pass, *Chaklam-la*, 5,285 m. high, being a rise at a rate of 1:13.3. From the pass to *Camp CCCLXII* at 4,905 m., we had 5.3 km., the fall being here 380 m. and the rate 1:13.9. On both the northern and the southern side, the range is, therefore, very well defined and its slopes unusually steep. The minimum temperature in the night was  $-13.1^{\circ}$ . The S. W. wind was not at all strong, and the sky was overclouded only at 1 o'clock p. m.

The valley leading up to the pass is, therefore, hard and steep. From the threshold of the pass, the view is much hindered by hills in the neighbourhood. To the south we beheld a labyrinth of rather high and difficult mountains. The southern horizon is formed by a high and dark range which seems to start from *Sha-kangsham*. Just under the pass, on its southern side, is a trough with good grass. Here a narrow valley begins winding S. W. At a few places it is as narrow as a gorge and its bottom is full of gravel. The living rock, cropping up in sharp teeth and rocky ridges and towers, consists of light grey crystalline limestone. A flock of 50 antelopes fled across the hill-sides. Here and there, some snow is left. Where the material is soft, a path is readily visible. Finally the little valley becomes broader and in front of us we see the next latitudinal valley with its ice-covered river. The river turns more and more to the west. On the floor of the main valley the ground was sand, and good grass was growing here. At an isolated hill, was a sheepfold. Sometimes the abandoned camping places of travellers were passed.

Pan. 441A and B, Tab. 81, shows the landscape seen from *Camp CCCLXII*. We see the course of the ice-filled river bed to the west, and how its valley turns to the W. S. W. between hills of no great height. To the N. W., west and N. E. is the range we had just crossed, cut through by several small valleys, and with rocky crests and peaks. The peak to the N.  $83^{\circ}$  E. and its neighbour to the right, seem to be detached from the principal range. To the S. E. is the valley of the river.

On *March 24th*, our route goes S. E. for 10.7 km. rising from 4,905 to 5,026 m. or 121 m., a rate of 1:88. The minimum temperature was  $-16.2^{\circ}$ ; a S. W. wind was blowing as usual, though not hard. At noon the sky became overclouded and it began to snow.

The ice bed was crossed, its breadth being 120 m., after which we marched up the valley between the left bank of the river and the base of the western hills. The ground is very gravelly. Higher up the bed was quite dry; the ice-sheets are, therefore, formed by springs. A shepherd with his sheep was seen amongst the hills and on the right bank two tents and, farther on, a *hle* or cairn with poles and rags; such of different shape are common here. From this cairn, *Sha-kangsham* was dimly

visible. The rest of the day it was hidden either by hills or by snow clouds. A slope from the western hills has to be crossed in a little threshold, the name of which was given as *Amchung-la*. At its foot was a tent near the bed of the river. The only information given by a woman of this tent was that the region belonged to the province of *Bongba*, and that we would have to cross the pass *Sangchen-la*, the next day. South of it we would come across a tent belonging to *Nakchu*, a district that seems to be situated west of *Naktsang* and not to be confounded with the famous river and district of that name, far to the east. South of *Sangchen-la*, there was a direct road to *Chokchu*.

Our direction becomes more and more south with the broad open plain of the valley to the east, south and north, and surrounded by considerable mountains and irregular interrupted ranges. However, one gets the impression that the principal orographical stretching is W. N. W.—E. S. E. and that *Sha-kangsham* is the culminating part of a short meridional range which possesses some other snow-peaks farther south, and morphologically resembles the *Targo-gangri*.

*Sha-kangsham* is also a mountain knot from which many ridges and ramifications start in different directions. From the southern end of its culmination crest, the range seems to start westwards, which was now in front of us. To the E. S. E. the mouth of a larger valley is seen, which comes from a group with eternal snow. From a distance, and from a route which, as a rule, follows the valleys, it is very difficult to make out the principal features of the orography.

We camped at the base of a little hill. Here, as at several other places in the course of the day, was a sheepfold, and there were heaps of dry dung of tame yaks. The grass was bad. Snow remained in beds. A Tibetan we met said that the region south of *Sangchen-la* was called *Atsok*. From the secondary threshold we had passed in the course of the day and which was called *Amchung-la*, one could see to N.  $48^{\circ}$  E. a much lower pass in the range we had crossed in *Chaklam-la*. The latter was, by some nomads, also called *Amchen-la*. The real *Amchung-la* was now said to be the saddle seen to the N.  $48^{\circ}$  E. As a rule it is impossible to feel quite sure of the reliability of the information given by the natives, unless it is checked from several informants.

On this day, we had not reached living rock. The gravel in the valley consisted of dark grey quartzite schist. Pan. 443<sup>A</sup> and B, Tab. 82, gives an idea of the complicated appearance of the world of mountains surrounding *Camp CCCLXIII*. To the N. N. W. and N. W. it shows the valley of the ice river continuing in a curved line between the hills. To the N. E., E. N. E. and E. S. E., it shows the ranges bordering the valley on the east. N.  $88^{\circ}$  E. and just right of it, are some of the peaks with eternal snow situated south of *Sha-kangsham*, and no doubt belonging to the same meridional range as the culminating group.

To the S. E. and south, is the range we would have to cross the next day in *Sangchen-la*. The river bed we had followed during the day's march, certainly came from the valley opening out from the east, and partly visible to the S.  $82^{\circ}$  E. on the panorama. This river, which had been called *Sangchen-gi-chu* by some nomads and *Sangchen-di-chu* by others, is certainly fed by the peaks with eternal snow situated south of *Sha-kangsham*, and visible to the N.  $88^{\circ}$  E. and east on the panorama. This river would thus play the same hydrographical part as the *Kangsham-tsangpo*, though it is much smaller than it. In how far it is a tributary of the latter or flows to another self-contained basin, is, as yet, unknown. So much is sure, that the part of Tibet where we were now travelling from north to south, is, on the whole, sloping to the west as is proved both by the direction of the river courses and by the fact that we have high mountains with eternal snow to the east, and low depressions, such as *Lakor-tso*, to the west.

*March 25th*, was given up to rest. The minimum temperature was down at  $-17.8^{\circ}$ ; the S. W. wind was fresh but not strong. At noon nearly half the sky was overclouded; the evening was clear. Three tents were found, each in a little valley south of the camp.

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## CHAPTER XXIII.

### OUR JOURNEY TO CHUNIT-TSO.

On *March 26th*, we made 8.3 km. south. The first 5 km., we ascended 330 m. or from 5,026 to 5,356 m., which is the height of the pass, *Sangchen-la*. The ascent was rather steep or as 1:15. On the southern side of the range we marched 3.3 km. to *Camp CCCLXIV*, where the absolute altitude was 4,946 m., thus being a descent of 410 m. or at a rate of 1:8, which was the steepest slope we had experienced. These figures prove that the range we crossed in *Sangchen-la* was very sharply marked and had unusually steep gradients both to the north and to the south. After a temperature of  $-17.7^{\circ}$  in the night, we had a S. E. breeze in the morning and then a S. W. breeze. The day was nearly clear.

Just south of the camp, we crossed an erosion-bed containing ice from a spring, after which the path took us across slopes and up through valleys to the one coming from the pass. The latter is double, both of about the same height. The view from the second one was not encouraging. To the south we had a confusion of considerable mountains, and deep below our feet was a valley stretching east and west. One of my men, who ascended a hill above the pass, reported the existence of a lake to the S. E. To the N.  $60^{\circ}$  E. the highest peak of *Sha-kangsham* is visible above all other mountains on this side of and beyond it, and the whole series of magnificent peaks belonging to its range are to be seen in all their beauty. One of them, in the shape of a white pyramid, raises its head to the N.  $81^{\circ}$  E. Not a cloud conceals this beautiful and imposing view. Unfortunately I was in disguise and observed by Tibetans and, therefore, was unable to sketch a panorama. S.  $19^{\circ}$  W. a snow peak is in sight, probably belonging to the range of *Lunkar-gangri*. On the pass the living rock was light grey quartzitic schist, the same as at *Camp CCCLXIII*, though there it was darker. North of the pass we had seen a little herd of *Gazella* antelopes. The *Pantholops* antelopes were now very rare. Near the pass we saw a herd of five *Ovis ammon*.

The slope down is very steep amongst sharp-edged gravel. Finally it becomes more gradual and goes over into the upper part of a valley where there was a tent

behind a projecting hill. At a distance, somewhat higher, another tent was pitched. *Camp CCCLXIV* was made in the erosion furrow of the valley where some snow was left. The grass was poor. An old Tibetan of a tent in our neighbourhood called the place *Nematok*. *Ki-ngoma* is a spring forming ice-sheets higher up in a tributary valley to the east. *Ladung-la* was the next pass on our road southwards.

In 9 days, representatives of all the nomads of this region would travel to the headquarters of the Puntso or governor one or two days westwards to pay taxes to him. They used to dwell some 25 days at his place.

From *Camp CCCLXIV*, Pan. 446, Tab. 83, is drawn showing the narrow and compact range to the north. To the left of N.  $15^{\circ}$  E., is the way up to *Sangchen-la*.

The next day's wandering, *March 27th*, took us 7.4 km. S. S. W. and S. W. First we had 3.5 km. to the pass, *Ladung-la*, 5,302 m. high, or a rise of 356 m., being a rate of 1:10. From the pass we had 3.9 km. to *Camp CCCLXV* at 4,878 m., or a fall of 424 m. being at a rate of 1:9. In both cases the gradients are, therefore, very accentuated, and the new range barring our way to the south, is as narrow and as well-defined as the one of *Sangchen-la*. The minimum temperature was at  $-19.6^{\circ}$ ; at 1 o'clock p. m. we had  $+8.4^{\circ}$ , finally a sign of approaching spring.

The valley leading up to the pass is very narrow, sometimes like a gorge. The hills on the sides are rounded and consist mostly of gravel and detritus without grass, but sometimes covered with moss. Marmots' holes are very numerous as the day before. There is only occasionally a path to be seen. A minimal watercourse came either from a spring or from melting snow. The view from the pass was favourable as there were no more passes for some four or five days. From the pass the slope is extremely steep and full of gravel. From the base of this first slope, the fall of the valley is moderate to the S.  $23^{\circ}$  W. It is largely filled with ice-sheets, sometimes occupying the whole floor of the valley. S.  $21^{\circ}$  W. a sharp-edged top is visible at a distance of 2 or 3 days, and S.  $15^{\circ}$  W. a continuous snow-covered range, obviously one of the *Transhimalaya* Ranges. S.  $25^{\circ}$  W. is also a peak situated on a range which seems to come to an end at S.  $33^{\circ}$  W. Between us and this range, there are several ramifications surrounding a plain. S.  $41^{\circ}$  W. a considerable snowy peak was rising, belonging to a range, the western continuation of which, came in sight at S.  $60^{\circ}$  W. from a point lower down the slope.

The valley at the south side of *Ladung-la* turned more and more S. W., and received small tributaries from the sides. The several springs contributed to a little brook of  $\frac{1}{4}$  cub. m. per second containing fish. Near a large ice-sheet, *Camp CCCLXV* was pitched. A little lower down was a tent, and flocks of sheep were seen in the vicinity. The place was called *Yanglung*. Pan. 444<sup>A</sup> and B, Tab. 82, gives a view of the range we had crossed and of the hills and ridges east and south of the camp.

From *Tongka-tso* on a distance of only 63 km. we had so far crossed six parallel ranges, as a rule running W. N. W.—E. S. E., and in height not to be compared with the magnificent ranges belonging to the *Transhimalaya* System farther south. These six ranges are, however, not to be regarded as continuous orographical features. On the contrary, it is pretty certain that they are short and interrupted. The range of *Sha-kangsham* seems to occupy a particular position as running in a more meridional direction, and as being higher than all surrounding ranges. It may be that some of the southern ranges we had crossed are to be regarded as ramifications from it. Nor is the distance very great, as the highest peak of *Sha-kangsham* is at 40 km. from *Camp CCCLXII*.

From *Camp CCCLXV* the ground sank to the south for three days. *March 28th*, we marched 8.2 km. S. S. W. and S. W., descending 137 m. or to the 4,741 m. of *Camp CCCLXVI*, being a rate of 1:60. The weather was good, and the minimum temperature sank to only  $-13.8^{\circ}$ . The march was monotonous as we went down along the brook, mostly on its left side. At its right side were two tents. To the east a tributary valley opened, on the slopes of which large flocks of sheep were grazing; a nomad asserted that the owner of them possessed 3,000 sheep in all. Farther on, three other tents were left to our right. In the mouth of another eastern tributary valley, was a big blue and white tent, the owner of which was said to be a certain Gova Chükyün, a chief of the district who also possessed 40 ponies grazing in a valley.

We made our *Camp CCCLXVI* at the left bank of the brook which carried very little, and perfectly open, water. The valley was broad and its floor even, like a plain. The grass was bad in the region. Here our caravan consisted of 2 ponies, 3 mules, 2 yaks and 23 sheep. We had now reached a region comparatively well inhabited, with a good many tents, large flocks of sheep and several *manis*, some of them adorned with yak horns. The merchant, Tsongpun Tashi, was living here. He called the valley *Kung-sherya*. The road we had heard about several times under the appellation of *Serpun lam* or the »gold-chief's road«, was now said to cross the *Kung-sherya* valley exactly at *Camp CCCLXVI*. It comes from S. E. and continues to the W. N. W. just to the right of N.  $81^{\circ}$  W. on Pan. 445A, Tab. 82.

Here for the first time we heard the name *Mendong-gompa*, which was said to be a monastery about three days to the S. E. and which we afterwards visited. The distance from *Camp CCCLXVI* to Mendong-gompa, is 75 km.

The Tsongpun Tashi reckoned 13 short marches from *Kung-sherya* to *Saka-dsong*, and gave the following names on the road, some of which we afterwards had an opportunity to check as being correct: *Garsang-chorten*, *Shore-tongpa*, with a tent, *Kotsang*, *Satsot-la*, a small pass, *Shampo*, *Shore-gola*, with tents, *Shakar-dung*, with tents, *Nima-lungisa*, *Korde*, *Bupgo-lathit*, a pass, *Samyas-la*, a high pass,

*Patsangguk (Pasaguk)*, *Rukyok* and *Saka-dsong*. More problematic seems the itinerary he gave from this camp to *Raga-tasam*, which passes by *Penchen*, *Chuner-sharlung*, with a pass, *Kinra*, *Chakung*, *Rungmar-pelung*, *Yupta*, *Rardsong*, *Tavuk-la*, a pass, *Madum-punu*, *Serva*, *Bonidar* and *Dorluang*, from which point still six days were said to remain.

Pan. 445<sup>A</sup> and B, Tab. 82, gives a complete view of the mountains surrounding *Camp CCCLXVI*. It begins with the very flat and comfortable pass to the W. N. W., by which the *Serpun lam* was said to pass. To the right of it, we have a continuous panorama of the northern range, the last we had crossed. Then follow the hills to the east of the valley, and to the S. S. W. the continuation of our valley which, by and by, turns to the S. S. E. And finally it shows a bulky group west of our valley.

On *March 29th*, we follow the *Kung-sherya* valley south for 13 km., descending 113 m. or to 4,628 m. at *Camp CCCLXVII*, being at a rate of 1:115. The temperature of the night was down at only  $-10.6^{\circ}$ , at 7 o'clock a.m. we had  $+13.0^{\circ}$ , and at 1 o'clock p.m.  $+15.3^{\circ}$ , being thus an amplitude of nearly  $26^{\circ}$  between day and night. The living rock just east of *Camp CCCLXVI*, was greenish sandy hard schist. The ground is excellent for our march. We travel on the base of the eastern hills and then along the ice-sheet in the bed of the brook. One black and one blue and white tent, and after a while, two black tents are left to the right. At the first 20 yaks were kept. Three new tents were left at 1 km. to our right. At several places in the broad valley, yaks were grazing and once a flock of sheep. A wolf was seen. Kyangs were grazing at two or three places. Finally we crossed the ice-bed and made our *Camp CCCLXVII*. Sometimes the latter was very broad and extended. The grass was bad. Pan. 447<sup>A</sup> and B, Tab. 83, represents a part of the surrounding hills. To the north our valley comes down, to the S.  $29^{\circ}$  E., is its continuation and our route the next day.

On *March 30th*, our route goes straight south for 10.6 km., descending only 16 m. or to 4,612 m. at *Camp CCCLXVIII*. But before reaching so far, or after a march of 8 km., we passed a depression of 4,580 m. which obviously was the lowest part of the whole valley. So far, the rate of fall was as 1:167, and south of it to the camp, the rise was as 1:81. At any rate it was surprising to find just north of the *Transhimalaya* System, a point with so insignificant an altitude as 4,580 m. or about the same altitude as on the *Tsangpo* on the same longitude.

The weather was good with little wind and clouds. The minimum temperature was down at  $-13.2^{\circ}$  in the night, and at 1 o'clock p.m., we read  $+14.6^{\circ}$ , giving an amplitude of  $27.8^{\circ}$ . It was the season in which the wild geese begin to move. Now and again we saw one, two or three of them flying over our camps. West of the hills to the west of *Camp CCCLXVII*, some of my men reported the existence of a little lake. During the last two days we had seen 20 tents, and on the 30th,

we saw 12 more. Still nearly all Tibetans asserted that the greatest numbers of sheep were grazing in the north, though we passed large flocks every day. The inhabitants of the tents were generally women, old men and children; the men were said to be absent with the flocks up in the north, where the grass was better. So much was sure, at any rate, that we had not met with so many nomads, tents and flocks farther north as here.

Our route goes between the base of the western hills and the bed of the brook, partly filled with rotten melting ice. The bed is very winding and there is some grass on its bank. Kyangs are very numerous in spite of the nomads. Of course I have only mentioned such tents as we saw. There are many others which were hidden in valleys and behind hills of which we only heard. Now, for instance, a man was seen coming to the brook with 20 yaks.

The eastern hills are not high. From the western, a projecting spur forces our direction to the S. S. W. At its southern side, three tents were pitched and beyond the brook, two. Farther on, seven tents were passed in three camps. Very large flocks of sheep were grazing at different places and sometimes yaks. The valley is here as broad as a plain, perfectly even to the eye. The *Sha-kangsham* is now out of sight. The ground is hard clay, with scarce grass.

We cross the brook at the point where the height was 4,580 m. Its direction is here S. S. W., but it may turn more to the S. W., and the deepest depression of the region may easily be situated west of our route. A short distance S. 20° W. of this point, we made *Camp CCCLXVIII*, in the vicinity of a lonely tent. There was a frozen spring and some grass. Dung of tame yak and of kyang is abundant everywhere. The name of the place was *Nila-yung-karpo*. In the course of the day we had passed several *manis* and cairns.

Pan. 448A, B and C, Tab. 83, shows the landscape all around the horizon. It gives a clear idea of the general habitus of the mountains in this region, flat rounded hills everywhere with no high peaks rising above the rest. To the right of S. 20° W., is the continuation of our valley which we had to follow the next day. To the north is a perspective of the part of the valley by which we had come in the day.

Here we were told that in two days we would reach a lake *Chunit-tso*, along the western shore of which our road continued south. A few days south of it, we would reach a river *Buptsang-tsangpo*, a name that we now heard for the first time. Four of the districts of the province of *Bongba* were mentioned: *Bongba-changma* or Northern Bongba, *Bongba-sherma* or Eastern Bongba, *Bongba-hloma* or Southern Bongba, and *Bongba-numa* or *-nubma*, Western Bongba. Later on we would hear the names of several other districts belonging to the same province.

On *March 31st*, we continued S. S. W. and S. W. for 10.7 km., now again rising 193 m. from the last camp to *Camp CCCLXIX*, where the altitude was

4,805 m., being a rate of 1:55. The minimum temperature was  $-14.1^{\circ}$ . The S. W. wind was fresh at 1 o'clock p. m. and the sky cloudy, though the clouds were thin and white. The evenings and nights were usually clear.

The valley by which we now continue S. S. W., has a little brook and large ice-sheets. It is hydrographically to be regarded as a tributary from the left, to the brook we had followed down from *Ladung-la*. The latter brook increases in volume, by and by, as it receives many contributions from springs. Finally it turns W. S. W., and perhaps N. W. to a little lake situated west of the hills. In its lower part, where the bed is broad, shallow and exposed, it does not contain fish. In its upper reaches, it is narrow, sometimes 1 or 2 m. only, and deep, sometimes  $\frac{3}{4}$  m., and the banks grass-covered and overhanging; there the fish are more protected.

The bottom of the valley is swampy and there is tussock-grass. Three sheep-folds were passed. At a narrow place the living rock was reddish grey porphyrite. Beyond this narrow passage, the valley again opens out to a plain between the mountains. The bed with the ice, seems to come from a comparatively high mountain to the S. E. where ice is seen in a valley. West of our route, two small, dry clay depressions are left. The surrounding hills are reddish yellow and of moderate size. In the neighbourhood of a lonely tent where snow was still left, we pitched our *Camp CCCLXIX*.

The information given us here agreed well with what we had heard before, and seemed to be reliable. The pass to the S. S. W., was called *Satsot-la*, and the lake beyond it, *Chunit-tso*. Five days' journey west, was the salt lake, *Tabie-tsaka*, the distance probably calculated from the rate of the march of sheep caravans, as it is, indeed, only 45 km. *Bongba-changma* was said to be north of *Sangchen-la*, *Bongba-hloma* on the *Buptsang-tsangpo*, and *Bongba-numa* at *Tabie-tsaka*. As to *Bongba-sherma*, it was placed in the region of Tsongpun Tashi, who had himself given us the name *Kung-sherya* of his district. Pan. 449A and B, Tab. 84, is of interest. S.  $25^{\circ}$  W. is the valley leading up to the pass, *Satsot-la*. To the west, comparatively high ridges hide the view in the direction of *Tabie-tsaka*. N.  $30^{\circ}$  E., *Sha-kangsham* is again visible like a lighthouse above the stone waves of the high-land sea. To the N.  $60-68^{\circ}$  E., the configuration of the ranges indicate a depression in which a lake may be situated, a matter that remains unsettled, as this part of Tibet has never been visited by a European. This depression is bounded on the N. E. by a distant range of a light blue colour and with two or three snow-peaks, which may belong to the same orographical system as *Sha-kangsham*.

On *April 1st*, our direction is S. S. W. for 9.8 km. We had 2 km. to *Satsot-la*, 4,856 m. high, the rise thus being 51 m. or at a rate of 1:39. From the pass to *Camp CCCLXX* at 4,747 m., we had 7.8 km. and a fall of 109 m., being a rate of 1:72. The minimum temperature was only  $-7.8^{\circ}$ , the day somewhat windy and

cloudy in the afternoon. This explains that the temperature at 7.30 o'clock a. m. was  $+8.2^{\circ}$ , and at 1 o'clock p. m.,  $+6.1^{\circ}$ . However, we had found that March is the month in which the power of the winter is broken and the spring begins. During the first half of March, the winter had been so cold that one or two of our mules had frozen to death. In the last days of March the weather was so hot, if there was no wind, that we had to lay off some of our winter clothes. The ice was rotten and melting, snow very rare, and insects began to move on the ground and in the air.

After crossing a little valley we entered the valley of *Satsot-la* with a well marked erosion furrow and much gravel. From the threshold of this little pass, which is only a little more than 100 m. above the surface of *Chunit-tso*, the view is open to the S. S. W. and S. S. E., the rest being hidden by hills. To the S.  $7^{\circ}$  W., a part of the lake is in sight, white to the left, blue to the right, indicating that it is still partly ice-covered. It occupies a large part of a flat depression which, to the south, is bounded by a mighty range with several snow-peaks and crests. But in the prolongation of the lake, or S.  $7^{\circ}$  W., the mountains appear lower and there we seem to have a favourable way for a few days.

Here we had thus discovered a new lake, belonging to the same curious chain of lakes, most of which had been discovered by Nain Sing. In this chain we may reckon *Tengri-nor*, *Mokicu-tso*, *Kyaring-tso*, *Chikut-tso*, *Marchar-tso*, *Ngangtse-tso*, *Dangra-yum-tso*, *Teri-nam-tso*, *Karong-tso*, *Chunit-tso*, *Tarok-tso*, *Tabie-tsaka*, *Poru-tso*, *Shovo-tso* and *Nganglaring-tso*. It is worth while remembering that the extensive latitudinal depression which is indicated by this chain of lakes, affords the most splendid northern boundary of the orographical system of *Transhimalaya*. *Shurnu-tso*, on the other hand, does not belong to this chain of lakes, as it is situated in the middle of *Central Transhimalaya*.

On the pass the rock consisted of red quartz-porphyrific dacite or tuff-porphyrific. The slope down is moderate amongst gravel. At its base the grass was good. Farther on, the clay ground is barren in some places. From the N. W. a large valley enters with a red conical mount in its background. In its mouth there is a spring surrounded with ice and grey clay hills. To the left, at the base of a conical hill which had been visible two or three days, was a tent and flocks of sheep. Three sheepfolds were passed. In the valley were the tracks of several hundred yaks, which had marched to the N. W. through the above-mentioned valley, obviously to *Tabie-tsaka* for collecting salt.

We ascend a flat ridge which borders the lake depression on the north. On its top was a *mani* with yak horns; two round *manis* had been seen on the southern side of *Satsot-la*. To the S.  $81^{\circ}$  E., opens a considerable valley at the southern base of the large conical mount. Just east of our route, is a little dry, clay depression. From the flat ridge we go down a terrace to an erosion bed, with

a large ice-sheet. In the neighbourhood, two armed men were watching 300 sheep. They proved to be merchants, and their sheep were loaded with salt in small sacks. They came from *Tabic-tsaka* which was pointed out as being situated N.  $55^{\circ}$  W., and they had been on the way for seven days. They had marched by the same N. W. valley where we had seen the tracks of the yak caravan. So far as I have been able to make out, there is no pass to cross on this road which follows a latitudinal valley. The men asserted that only natives of *Bongba* were allowed to break salt from *Tabic-tsaka*, all other Tibetans having to pay taxes. The district of the salt lake, they called *Bongba-barma*. *Camp CCCLXX*, they called *Tuputok* and the little depression N. E. of it, *Chabuk-tso*. Then they slowly disappeared to the S.  $60^{\circ}$  E. Their home was at *Yangchut-tanga*, 20 days E. S. E. They march very slowly, and the sheep graze during the march. A lonely wanderer told us of the pass, *Nima-lung-la*, farther south. Wild geese became more numerous, flying north as a rule.

Pan. 450A and B, Tab. 84, gives an idea of the region just described in words. To the north, is the entrance of the valley which, turning to the left or N. W., goes to *Tabic-tsaka*. N.  $13^{\circ}$  E. is the direction of *Satsot-la*, N.  $63^{\circ}$  E. is the comparatively high conical hill, and to the east is the mouth of the large tributary valley mentioned above. To the south is the depression of *Chunit-tso*, and to the S. W. and west a part of the range along which we were to go south the next day.

On *April 2nd*, we continued S. S. W. for 14.5 km. to *Camp CCCLXXI*, which has about the same height as the previous one or 4,747 m. The minimum temperature was  $-11.6^{\circ}$  and the day was windy and cloudy. The morning was nearly always clear and calm. Many flocks of wild geese were coming to and leaving the open water of the frozen pool near the camp. Another very shallow and frozen pool was situated south of the camp, and should rather be regarded as the cut-off northern-most end of *Chunit-tso*. At its northern shore very near our camp, several springs come up. One of them was as hot as it could be on this height, the water boiling and sending up small clouds of vapour. The water has a sulphureous odour; it is surrounded by formations of calcareous sinter. A little brook from this spring enters the pool which is kept open for a short distance by the hot water. The red conical mount belongs to a range stretching N. N. W.—S. S. E. and running along the eastern shore of the lake.

Leaving *Camp CCCLXX*, we follow the eastern shore of the pool and soon reach the northern end of the lake. The pool is in connection with it by means of a broad bed between low terraces; in this bed the water partly runs below the earth. The pool is only a trifle higher than the lake, *Camp CCCLXX* being only 2 m. above *Chunit-tso*, which, therefore, is at 4,745 m. Along the western shore of the lake, the soil consists of light grey clay, perfectly even. The water of the



lake has a brackish taste, as has also the pool, though several of the springs are fresh. After a few kilometers, we cross an old beach-line and go up on the top of a terrace consisting of hard, fine gravel, below which the clay ground continues. West of our route, is a range with ramifications and valleys; from one of the latter a little brook comes down; on its bank is a tent. Along the shore, there are several springs forming small pools surrounded with grass. The greater part of the lake was frozen. In the background of a new valley from the west, there is a dominating, prismatic mountain. Along the base of the hills, the ground is barren, as usual. It is noteworthy that there is more and better grass in northern *Chang-tang* than here, which may to a certain degree, depend upon the consistence of the ground, being more gravelly in the south.

The water in the next little brook was quite red, probably it came from melting snow on some slope of red material. The next brook, like the others, entered the lake which seems to be fed by springs. The even plain along the shore, becomes broader. Near *Camp CCCLXXI*, a brook came out from the valley called *Sninkuk*, forming an ice-sheet some 300 m. broad in the bed outside the valley. Here two tents were pitched and flocks of sheep were grazing on the neighbouring slopes.

From *Camp CCCLXXI*, situated at the mouth of the valley *Sninkuk*, Pan. 452, Tab. 85, was sketched. N.  $33^{\circ}$  E., the red conical hill is visible and to the N. E. and east, the bulky and dark mountains on the eastern side of the lake. From our route it is impossible to see how broad the plain is along the eastern shore of the lake. It has the appearance of being very narrow, which, however, may be an optical illusion. To the S.  $62^{\circ}$  E., the country is very flat and open, and here indeed is a latitudinal valley just north of *Karong-tso*. In the background of this valley we had seen, from a point just north of the camp, a range which might be the E. S. E. continuation of the one with the pass of *Nima-lung-la*. North of this latitudinal valley, there is, to the S.  $84^{\circ}$  E., a culminating peak. S.  $35^{\circ}$  E. is a conical peak, not very high, but dominating, as it is surrounded by comparatively low ridges. Of the depression of *Karong-tso*, nothing could be seen, nor did the nomads say a word of its existence. It was impossible to get any clear idea of the country to the south. The southern horizon, however, was barred by a mighty dark mountain range with some snow. We were approaching the *Transhimalaya*!

During the last days we had passed many tents and many flocks of sheep, as well as yaks. When leaving *Camp CCCLXXI*, we had seen on the hillsides to the east, at least 400 yaks in three flocks. These may perhaps have belonged to merchants bringing salt from *Tabie-tsaka*.

At *Camp CCCLXXI* we have come into connection with my fifth crossing of the *Transhimalaya*, the description of which has been given in Vol. III, p. 314 *et seq.*



ALONG THE UPPER SATLEJ



## CHAPTER XXIV.

### FROM MANASAROVAR TO THE SHIB RIVER.

In Vol. III of my personal narrative, »Transhimalaya», I have given a description of the last section of my journey in Tibet, from *Camp CCCCLI* to *Camp CCCCLXXXV*, in and along the valley of the *Satléj*, from *Tokchen* to *Poo*, the first station in British India I reached. This description, however, chiefly deals with my personal experiences and adventures as well as with the monasteries along the road. A number of photographs and sketches illustrate it, to which I refer. There now remains only to give a short report of the chief geographical features of the same road, a report which properly will have to be regarded as an explanatory text accompanying the last part of Pl. 24 and the whole of Pl. 25 and 26 of my map. This text is at the same time, a direct continuation from the chapter on my sixth crossing of the *Transhimalaya*, Vol. III, p. 324 *et seq.* of the present work. The first stages of this section of the journey, took me along the shores of the *Manasarovar* and *Rakas-tal Lakes*, and will, therefore, be particularly briefly described, as all my observations on and around the lakes have already been entered in Vol. II of the present work. The same may be said regarding the old bed of the *Satléj* and the relation of this river to the *Rakas-tal*. This problem has been dealt with in Vol. II, p. 169.

At *Tokchen* on the *Samo-tsangpo*, we were at a height of 4,634 m. and travelled down the river, *July 24th*, 1908, to the mouth of the valley where the last good grass was growing and the height was 4,611 m. The minimum temperatures of the nights, were now always above the freezing point with only one or two exceptions. The meteorological observations will be found in Vol. VI. of this work.

The next day's march took us down to the northern shore of *Manasarovar*, the even plain of the shore being bounded by a terrace of gravel. On the plain the grass was very good and thick. Here the oblong lagoon, which some Tibetans called *Ting-tso*, is to the right of our course and is in connection with swamps. It had now changed its outlines since 1907 and contained more water. The brooks,

*Pachen* and *Pachung*, enter the lagoon from the north, and their water leaves it to the south and forms an affluent to the *Manasarovar*. The joint river now had, at the place where we crossed it, a breadth of exactly 100 m., an average depth of 0.15 m. and an average velocity of 0.35 m. The volume of water amounted to 5.25 cub. m. per second. The water was nearly clear, the bed consisted of sand and silt, partly very soft, as the animals sank deep into it.

We then followed the narrow neck of land between the lake and the lagoon. It is a terrace with slopes on both sides. Along the very edge of the lake, there is a series of very small lagoons which will be inundated during years with an out-flow to *Rakas-tal*. *Mount Pundi* was in sight the whole day, *Gurla-mandata* was hidden by clouds, and *Kailas* got rid of its clouds towards evening. *Camp CCCCIII* was pitched on the left bank of the little river *Gyuma-chu*, on the right side of which the monastery of *Langbo-nan-gompa* was situated. At our camp the little river was now 12.41 m. broad, its average depth being 0.39 m., and its average velocity 0.83 m., the volume of water was 4.014 cub. m. per second.

On *July 26th*, we travelled along the shore to *Chiu-gompa*, passing *Chärgip-gompa* on the way. It was the same road as in 1907 (*Cp. Pl. 12*). The next day we continued N. W. at some distance north of the bed, from *Manasarovar* to *Rakas-tal* and near the latter lake, entered ground that was new to me. It was slightly undulated, partly barren but north of the lake very rich in excellent grass, where the inhabitants of *Parka* use to have their flocks in winter. *Mount Kailas* seemed to be a little more snow-covered than the previous year.

On *July 28th*, we continued across the grass steppe, crossing the river which comes down from the *Kailas* and surrounding mountains. A Tibetan called it *Toan-hle-hlachu*, which, however, seems doubtful. It is obviously formed by the two rivers which come down on each side of the *Kailas*, the eastern being called *Dopchen-chu*, the western, *Hlachu-chu*. According to Ryder's map, Sheet No. 14 S. W., two rivers from the mountains to the N. N. E., join just a little above *Parka*. These two rivers are obviously identical with the two I surveyed on the *Kailas*. It enters the *Rakas-tal* at about the middle of its northern shore. I made an approximate calculation of its volume of water, the breadth being 125 m., the average depth 0.3 m. and the average velocity 0.4 m. The volume would thus be about 15 cub. m. per second, which may be considered as a large affluence. Another much smaller affluent from the north, which also is to be found on Ryder's map, may come from *Khaleb*. This, however, I cannot make out, as I have not followed the course of these rivers up to the mountains north of the lake, from which they come. On *Pl. 12* it will be seen that I, in 1907, crossed the same river higher up and west of *Parka*. On my way from *Parka* to *Khaleb*, I crossed two watercourses, *Sung-chu* and *Lashu* (*Hlachu?*) which seem to correspond to the two rivers on each



START FROM A CAMP SOUTH OF NGANGLARING-TSO.



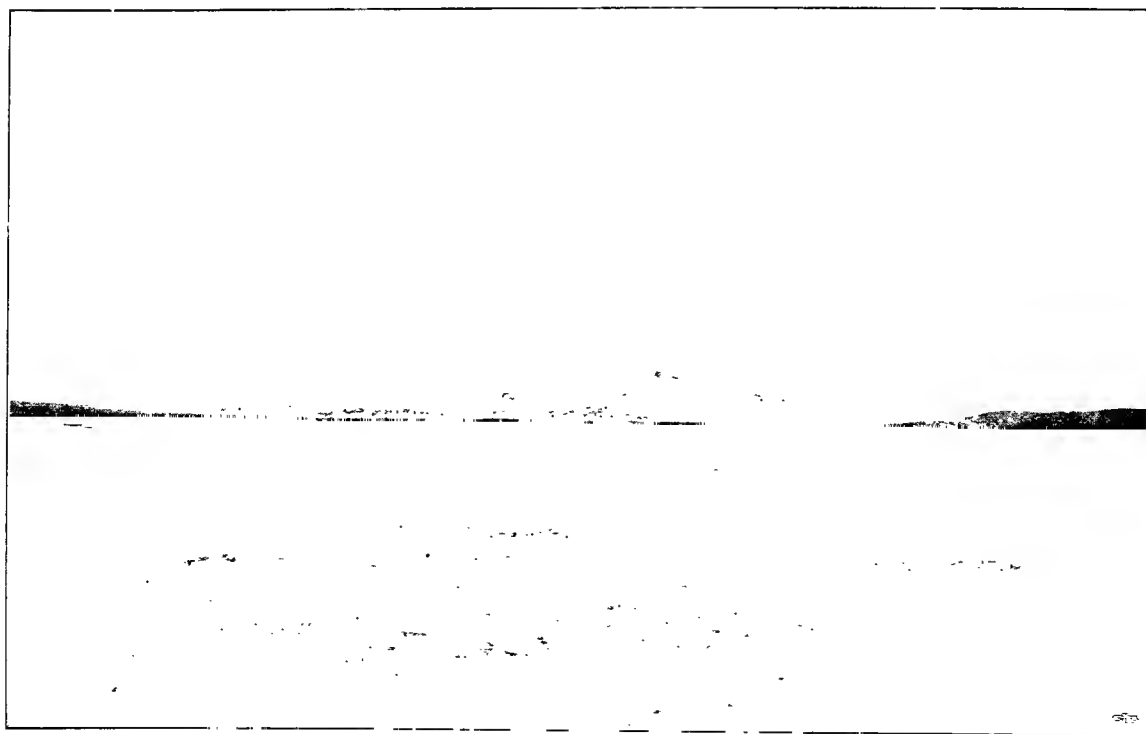
MY LAST RIDING PONY.







THE KAILAS FROM KHALEB. HEIGHT 22028 FEET OR 6716 M (BURRARD).



THE GURLA-MANDATA (MAMO-NANI) FROM KHALEB. HEIGHT 25355 FEET OR 7730 M (BURRARD).



side of the *Kailas*. At 2 km. from *Camp CCCCLVI*, our road crossed a rather insignificant depression with swampy ground which farther S. E., contained some pools of stagnant water. This was the old bed of the *Satlej*. Then it was left out of sight until *Camp CCCCLVI*, *Serlep-yung*, which was pitched at the left side of the *Satlej* bed. Here it contained both pools and springs, though the water was not good. According to my instruments, the absolute altitude of the place was 4,585 m. This would be 4 m. below the surface of *Rakas-tal*, and we would have passed the little threshold, from which the *Satlej* bed begins to fall N. W.

As the hypsometrical relations along the valley of the *Satlej* are of great interest, and give a very clear conception of the accentuated relief, I am going to give the distances and absolute altitudes of the following stages. We have just left the *Manasarovar* with 4,602 m. and *Rakas-tal* with 4,589 m., and our journey from *Tokchen* to *Serlep-yung* has been accomplished at approximately the same altitude, or on the platform of a high plateau-land surrounded by gigantic mountains. We have found that the plateau-land of *Manasarovar* was somewhat higher than certain parts of the *Chang-tang* plateau, for instance, between *Camps CCCLXVII* and *CCCLXVIII*. From the mountains surrounding the Sacred Lake, the *Brahmaputra*, the *Indus* and the *Satlej* take their rise, their upper courses and their upper tributaries belonging to what v. Richthofen calls the peripheric region, inside of which is the great self-contained area of Central Asia. The greater part of my journey falls within the boundaries of the latter area. My journey along the *Satlej*, traverses a mountainous country, a part of *Himalaya*, that is typically peripheric. The road I took is well-known since many years, and has been described several times. Still I enter my own geographical, topographical and hypsometrical observations, or, at any rate, their principal features, in order not to miss the opportunity of giving an example of the great morphological difference between the plateau-land with the horizontal lines prevailing, and the peripheric region with the vertical, or at least very steep lines, prevailing. The profile line of the route, of course, becomes very irregular on account of its not running along the river itself, which would be impossible, as the river flows, for long distances, in deep-cut gorges with vertical rocks. It runs wherever it is possible, between hills and across passes at the sides of the river. Therefore, though the road as a whole goes down, it sometimes happens that a certain camp has a greater altitude than the one preceding. During the first stages from *Serlep-yung*, where the slope downwards begins, the fall is very gradual, sometimes insignificant, though not quite as gentle as the *Gartong* and Upper *Indus*. The great differences of altitude belong to the latter half of the road.

Thus the section from *Serlep-yung* or *Camp CCCCLVI*, on a march of 13 km., on *July 29th*, 1908, to *Chukta-lungpa* or *Camp CCCCLVII*, the ground rises from 4,585 m. to 4,615 m. or 30 m. which is a rate of only 1:433. The rise of the

ground here, depends on the fact that *Serlep-yung* is situated at the old bed of the *Satlej*, whereas *Chukta-lungpa* is on a tributary to the right of the main river. The first 5.5 km. of our road, followed along the left bank of the old bed, which gradually became more and more distinctly cut out in the ground and its erosion terraces became more clearly developed. Sometimes the latter even made the impression of still being under the influence of erosion. Now, the bed contained more water than the previous year, though practically only pools of stagnant rain-water. From the slopes of the hills to the S. W. of the bed, several erosion furrows and ravines came down, joining the *Satlej* bed, now all of them dry. During and after rain they bring their tribute to the *Satlej*, the course of which, therefore, becomes regenerated already a short distance west of the threshold and after the interruption of its course by the *Rakas-tal*. To avoid the tributaries, we cross the bed of the main river, and begin slowly to rise S. W. towards a secondary threshold, leaving to our left the rocky gate by which the *Satlej* enters into the first of its narrow gorges.

A road to *Gyanima* coming from *Parka* and other places, here crosses the *Satlej* and leaves the gorge to the right, ascending to another threshold on the left side of the river. The mountains south of the river, were called *Amar*. *Chukta-yogma* and *Chukta-kongma* were said to be transverse valleys in the mountains to the N. E. of the road to *Gartok*. *Damgong-lungpa* is a little valley in the nearest hills to our right. *Lamchuger-tsangpo* is a brook, and then *Ninchung-lungpa* a valley also to our right. *Rong-chung* was said to be the name of the *Satlej* gorge. I cannot regard these names as reliable as they were given by the single guide we had and there were no inhabitants or wanderers to ask.

Our road slowly rises to the little, flat threshold, *Ninchung-la*, with a cairn at the height of 4,645 m. The ground is traversed by several small furrows going down S. W. to the *Satlej*, all without water. At *Chukta-lungpa*, our camp, there was a brook with water, about 0.1 cub. m. per second. It pierces the rock in a deep-cut gorge down to the *Satlej*. Only a caravan of sheep on its way to *Gyanima*, had been seen. Kyangs were grazing here and there. It had rained the whole night as in the afternoon the day before.

On *July 30th*, our road goes W. N. W. for 10 km., falling to 4,517 m. at *Camp CCCCLVIII*, *Dölchu-gompa*. The fall is 98 m. in this distance or at a rate of 1:102. The road crosses a little insignificant threshold beyond which it goes down to the sharply marked valley of *Chukta-kongma*. There is some tussock-grass. To the left is a hill called *Naga-nakbo*. West of the valley, the ground again rises to a very low threshold, after which we have a plain to the south and low hills to the north. The whole country falls southwards to the valley of the *Satlej* which is out of sight. Several small beds go down to the

south, some of them containing stagnant rain-water in small pools. To the south is the region, *Horgyawa*, with a place called *Ngangtsang*; west of it, we have *Yumba-taktsa* with a place, *Gya-shaotse*. The ground consists of fine gravel with some grass. About halfway, the living rock was yellow, fine, crystalline limestone. The little monastery, *Dölchu-gompa*, is situated on the flat slope of a low hill on the right side of the *Satlej*. Here we were 72 m. below the surface of *Rakas-tal*. On the left bank of the *Satlej*, 14 tents belonging to Ladaki and Gurkha merchants, were pitched.

The next march, *July 31st*, goes 15.5 km. N.W. along the *Satlej*, the river falling 85 m. or to 4,432 m. at *Camp CCCCLIX*, the rate being as 1:176. The fall of the river is, therefore, still very gradual. The road follows the southern base of the hill, down to the bed of the *Satlej* which now, after the rain of the previous day, had a good deal of brownish grey water. From the left, the river receives the two tributaries, *Sheri-namking* and *Charike-tangma*. The road crosses the *Satlej*. In a widening of the valley, there was at the left side of the river, a pool of rain-water.

After crossing the *Satlej* once more, we reach the point where the right terrace is broken through by a considerable tributary, obviously coming from the *Trans-himalaya* and crossing the *tasam* or highroad to *Gartok*. The gravelly floor of the valley is first traversed by 3 or 4 smaller branches after which follows the main branch, being 53 m. broad, 0.3 m. deep as an average and with an average velocity of 1 m. the volume thus being approximately 16 cub. m. per second. The water was thick with solid material and streamed with great force and noise. It had rained the whole day before, and the drainage area of this tributary had obviously been specially exposed. The rest of the day, we follow the right side of the joint river, which from here gradually increases and grows to the mighty *Satlej*. We stick to the floor of the valley, riding amongst gravel and with an erosion terrace 8 or 10 m. high immediately to our right. Above this terrace there is another about 30 m. above the river. The left terrace is well marked the whole way though, lower down, one sees three terraces, the highest some 40 m. above the river. They prove that at an earlier period, large quantities of water have flowed down through the bed, at a time when the *Manasarovar* and the *Rakas-tal* were in uninterrupted communication with the river.

After a while we cross another tributary from the right piercing the terraces in the same way as the first, and carrying 3 cub. m. per second of yellowish brown water. At several places in the valley, springs come up and every one of them delivers its tribute to the *Satlej*. Very often the river is divided into two or more branches, where the valley is broader. Sometimes the ground is swampy from spring-water. For a few km. the river flows to the W. N. W. As a rule the bed is 100 or 200 m. broad between the terraces, and 2 or 3 km. between the bases of the mountains. In

the bottom of the valley, there is often excellent grass. Hares are the only animals we see. For a short distance, the road goes on the top of the lowest terrace where the ground is gravel. On the left side, is a red hill called *Mapcha-tibu*, in the vicinity of which, a little lake or pool is said to exist. Having passed two empty shepherds' camps, we again go down from the terrace. A little farther on, we camp at a place where the *Satllej* is divided into two branches, and the region is called *Tertapuri-shung*.<sup>1</sup> Opposite this place, a left tributary valley called *Tara-kungyok*, enters the *Satllej*. *Yitum* and *Karpo-ninde* are said to be regions to the S. W. At our camp, an abundant spring of limpid water came up from several openings on the right bank and carried perhaps  $\frac{3}{4}$  cub. m. per second. Its temperature was  $11.55^{\circ}$ , whereas the river, above the spring, was  $16.25^{\circ}$ .

On *August 1st*, we travelled 12 km. N. W. and W. N. W. on the right or northern side of the *Satllej*, the ground falling 87 m. or to 4,345 m. at *Camp CCCCLX*, being at a rate of 1:138. It rained hard the whole night; in the morning, there was no precipitation; before 10 o'clock a. m., it began again and continued except for one hour; from 1 to 3 o'clock p. m. it rained very hard. I got a good illustration of the summer rains in the Himalayas and how they fill the beds of rivers and brooks with muddy water, making journeys in these regions somewhat difficult.

Only a few hundred meters below *Camp CCCCLX*, the *Satllej* enters, to the N.  $70^{\circ}$  W., a very narrow rocky gate with steep sides, which forces us to ascend the right terrace, here about 50 m. high. After a few minutes, we find that the terrace is pierced by a valley coming from N.  $46^{\circ}$  E. and called *Tokbo-shär*. On its floor, the greyish yellow and winding river of that name is streaming with great noise and roar, and on its sides, the bottom of the valley is partly filled with gravel, partly overgrown with good grass. We descended again from the terrace. The river was divided into three branches and the maximum depth was exactly 1 m. I made an approximate calculation of the volume. The first branch had a breadth of 7 m., an average depth of 0.3 m., and an average velocity of 1 m., the volume being 2.1 cub. m. per second. The second branch had a breadth of 22 m., an average depth of 0.5 m. and an average velocity of 1.5 m., the volume being 16.5 cub. m. per second. The third branch was 11 m. broad, had an average depth of 0.4 m. and an average velocity of 1.6 m., the volume thus being 8.3 cub. m. per second. The whole volume of the river was, therefore, 26.9 cub. m. per second, showing the influence of the last rains on the dimensions of *Tokbo-shär*.

On the other side, we had again to ascend the 50 m. terrace, but here we had an older terrace to the right, being some 10 m. higher. Two or three dry

<sup>1</sup> The correct spelling would be *Tirthapuri*, but I have used the pronunciation I heard at the place. Therefore, I have also *Tretapuri* (not *Tertapuri*) for *Camp CCCCLX*.

ravines are crossed. After a while we again had to go down to a tributary valley, of much the same appearance as the first, the *Tokbo-nub*. This was divided into two branches. The first was 22 m. broad with an average depth of 0.5 m. and an average velocity of 1.6 m., its volume being 17.6 cub. m. per second. The second had a breadth of 11 m., an average depth of 0.4 m. and a velocity of 1.5 m., its volume being 6.6 cub. m. per second. The whole river, therefore, now carried 24.2 cub. m. per second. These two tributaries, the eastern and western *Tokbo*, brought, therefore, down to the *Satlej* the considerable amount of 51 cub. m. per second, a volume that would increase if the rains continued. Together with the two tributaries of the previous day, we had, therefore, already controlled 70 cub. m., not counting the brooks from the left tributaries nor the additions from springs. In these high parts of its course, the river will change in volume from one day to the next, only lower down the quantity of water will be more regular and steady.

From the *Tokbo-nub*, we ascended the 50 m. terrace a third time, where the ground for several kilometers was nearly even and consisted of gravel with some bush vegetation. Here and there, cairns and a round *mani* were built; a few ravines were crossed. To our right we have low flat hills, being the remains of old terraces, and beyond them the *Transhimalaya*, now snow-covered, was dimly seen through the rainy dusk. Two or three hundred meters to our left, the *Satlej* was streaming in its deep-cut gorge which it has carved out in solid rock. Now, after the rain, it seemed to fill its bed completely. The last bit of the day's march winds amongst low hills and slopes, and here the *Tirthapuri-gompa*, or *Treta-puri*, as it is pronounced, appears at the foot of white and reddish yellow rocks. It is situated on a platform or top of a terrace, and below it are many *chortens* and a *mani* over 100 m. long. Dorche Pagmo-lagang is a part of the temple near the bank of the *Satlej*.

The lamas affirmed the names of the tributaries we had already crossed as being from west to east: *Tokbo-nub*, *Tokbo-shär*, *Goyak* and *Chukta*. At the right side of the mouth of *Tokbo-shär*, the rock was yellow, fine crystalline limestone. At the monastery, the living rock was grey, partly recrystallised, limestone. Greyish white fine-grained quartzite was also seen. The whole slope near the monastery is full of curious formations of calcareous sinter, some of them reminding one of stalagmites and obviously formed by springs. The *Satlej* has cut its bed down through limestone. It is a curious fact that where the right tributaries enter, as *e. g.* at the mouth of the *Tokbo-shär* and *Tokbo-nub*, their beds become very narrow just at the entrance to the main valley, and that, in each instance, a rocky gate is open to the *Satlej*. The fall of the tributaries is also much steeper than that of the main river. Below the temple, two hot springs come out with boiling water, sending up clouds of vapour; they are surrounded by calcareous sinter.

On *August 2nd*, we continued down the *Satlej* which already here is a magnificent river, travelling, as hitherto, on its right bank. The direction is W. N. W., the distance 7.9 km., the fall 50 m. or to 4,295 m. at *Camp CCCCLXI*, being a rate of 1:158. The road goes along the base of the lowest terrace. To our left are splendid meadows of intensely green, fresh grass, and at some distance, the river. The bed of the *Satlej* which, above *Tirthapuri*, has received a tributary called *Gyamo* from the left, is here more flat and shallow in accordance with the valley which is more broad and open. Caravans of yaks and single horsemen, on their way to *Gyanima*, crossed the river at well-known fords.

After a few kilometers, we pass the mouth of the considerable right tributary valley by which the river, *Menser-chu*, comes down. Here it seems to come from N. 28° E. A few km. higher up on it, is *Menser*, a station on the *tasam* or high road. The river was said to have two feeders from two different valleys. *Menser-chu* now had a breadth of 18 m., an average depth of 0.5 m., a velocity of about 1.5 m. and a volume of 13.5 cub. m. per second. Two small branches east of it carried 3 cub. m., so the whole river had about 16 cub. m. per second.

From here the road continues nearly west along the base of the terrace, still with luxuriant grass along the *Satlej*. The large river, which thus has got another considerable addition to its volume, sticks to the left side of its valley. Four very sharply marked terraces are seen on the left slopes, the highest perhaps 100 m. above the river. The road then traverses yellow ground of alluvial clay. At a projecting part of the terrace, called *Gerik-yung*, was a well-known camping place, as could be seen from the remains of caravans. A short distance below this point, the *Satlej* enters a rocky gate and begins a new narrow passage of its course. Just above the gate, a large tributary joins the river from the south. It is called *Halchor-chu* and is said to come from the two valleys, *Minchen* and *Minchung*, and from *Gyanima* and *Shayok*. A Lama who accompanied us, pretended that *Halchor-chu* was as big as the *Satlej* itself, which could not be determined from our route, but may be true.

From *Gerik-yung*, Pan. 545A and B, Tab. 103, was drawn. To the north and N. E., in the foreground, it shows the still low and flat beginning of the range which farther to the N. W., separates the *Gartang River* from the *Satlej* and is a part of the *Ladak Range*. It is, indeed, so low that a series of high Transhimalayan peaks are visible above its crest. The perspective of the *Transhimalaya* disappears to the east and E. S. E. In the foreground, the terraces may readily be discerned, pierced by northern tributaries. To the S. E. and S. S. E. there are also terraces. About south is the extensive valley of *Halchor-chu*, and to the right of S. 31° W., we get a glimpse of the narrow gorge of the *Satlej*.

On *August 3rd*, we marched 9.5 km. to the W. S. W., sinking 27 m. only, or to the 4,268 m. of *Camp CCCCLXII*; the rate of fall is thus 1:352, showing that



the fall of the river still is gradual. As the river here passes in its rocky gorge, the road has to wind amongst the mountains north of it. The descent is, therefore, by no means gradual, on the contrary, the road goes up and down the whole time. It crosses two secondary thresholds, the highest of which is 4,535 m. high or 240 m. above *Camp CCCCLXI*. Our road at first runs S. W. with a low ridge to the right and swamps and meadows with springs to the left. The projecting spur of the ridge near the *Satlej* is called *Palgye-pugu* and on its top, there are ruins of walls called *Kardong*. Just west of the spur, a valley, *Charnak-chu*, comes down from the region of *Jarko-la*, so far as it is visible from the N. 6° W. This river was not very swollen; it was divided in several branches, and an approximate calculation gave a breadth of 73 m., an average depth of 0.15 m., a velocity of 1 m. and a volume of 11 cub. m. per second. The water was nearly black. Thus the *Satlej* receives a new considerable addition. The largest tributary so far, is, however, the *Halchor-chu*, which now is visible, coming like a brownish grey body of water out of its narrow valley to the S. E. If it were true that this river was as big as the *Satlej*, the joint river should, below its entrance, carry at least 180 cub. m. per second and should, therefore, already here, be much larger than the *Tsangpo* the summer before.

At the junction with the *Charnak-chu*, the valley is broad and flat and the *Satlej* divided into several branches. The landscape begins to assume the features of cañons, with very steep slopes and terraces; at the right side of the *Charnak-chu*, there is a block standing, at the base of which are the ruins of 10 *chortens*; another *chorten* is seen on the bank of the *Satlej*. Just below this widening, the *Satlej* enters its narrow gorge, where there is no possibility of progress, at least not in this season. The road, therefore, has to cross two ramifications from the mountains on the right side and two secondary thresholds. First one has to cross the mouth of the valley, *Tsaldöt*, which is narrow and by which no road or path exists to higher regions. On its other side, our road goes very steeply amongst gravel and small furrows up to the first threshold, *Tsaldöt-la*, from which we have a fine view backwards the way we have come, the valley being visible so far as the drizzle allows. It is a very picturesque view. The ridges and ranges surrounding us are of about the same height and give one the impression of a general evenness. But the *Satlej* and its tributaries are deep-cut in nearly vertical cañons down through the earth's surface. The *Transhimalaya* was not in sight on account of the rain. Though the *Satlej* is quite close to our left, it is not visible, but we see its winding gorge with nearly vertical rocks. Beyond *Tsaldöt-la* the road may be about 200 m. above the river. The ground is rocky or full of gravel and blocks, and sometimes we have real abysses to our left. The first pass is 4,495 m. high, the second one is 4,535 m. From the latter we have a fine view of the slightly winding *Satlej*

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From *Gerik-yung*, Pan. 545A and B, Tab. 103, was drawn. To the north and N. E., in the foreground, it shows the still low and flat beginning of the range which farther to the N. W., separates the *Gartang River* from the *Satlej* and is a part of the *Ladak Range*. It is, indeed, so low that a series of high Transhimalayan peaks are visible above its crest. The perspective of the *Transhimalaya* disappears to the east and E. S. E. In the foreground, the terraces may readily be discerned, pierced by northern tributaries. To the S. E. and S. S. E. there are also terraces. About south is the extensive valley of *Halchor-chu*, and to the right of S. 31° W., we get a glimpse of the narrow gorge of the *Satlej*.

On *August 3rd*, we marched 9.5 km. to the W. S. W., sinking 27 m. only, or to the 4,268 m. of *Camp CCCCLXII*; the rate of fall is thus 1:352, showing that

the fall of the river still is gradual. As the river here passes in its rocky gorge, the road has to wind amongst the mountains north of it. The descent is, therefore, by no means gradual, on the contrary, the road goes up and down the whole time. It crosses two secondary thresholds, the highest of which is 4,535 m. high or 240 m. above *Camp CCCCLXI*. Our road at first runs S. W. with a low ridge to the right and swamps and meadows with springs to the left. The projecting spur of the ridge near the *Satlej* is called *Palgye-pugu* and on its top, there are ruins of walls called *Kardong*. Just west of the spur, a valley, *Charnak-chu*, comes down from the region of *Jarko-la*, so far as it is visible from the N. 6° W. This river was not very swollen; it was divided in several branches, and an approximate calculation gave a breadth of 73 m., an average depth of 0.15 m., a velocity of 1 m. and a volume of 11 cub. m. per second. The water was nearly black. Thus the *Satlej* receives a new considerable addition. The largest tributary so far, is, however, the *Halchor-chu*, which now is visible, coming like a brownish grey body of water out of its narrow valley to the S. E. If it were true that this river was as big as the *Satlej*, the joint river should, below its entrance, carry at least 180 cub. m. per second and should, therefore, already here, be much larger than the *Tsangpo* the summer before.

At the junction with the *Charnak-chu*, the valley is broad and flat and the *Satlej* divided into several branches. The landscape begins to assume the features of cañons, with very steep slopes and terraces; at the right side of the *Charnak-chu*, there is a block standing, at the base of which are the ruins of 10 *chortens*; another *chorten* is seen on the bank of the *Satlej*. Just below this widening, the *Satlej* enters its narrow gorge, where there is no possibility of progress, at least not in this season. The road, therefore, has to cross two ramifications from the mountains on the right side and two secondary thresholds. First one has to cross the mouth of the valley, *Tsaldöt*, which is narrow and by which no road or path exists to higher regions. On its other side, our road goes very steeply amongst gravel and small furrows up to the first threshold, *Tsaldöt-la*, from which we have a fine view backwards the way we have come, the valley being visible so far as the drizzle allows. It is a very picturesque view. The ridges and ranges surrounding us are of about the same height and give one the impression of a general evenness. But the *Satlej* and its tributaries are deep-cut in nearly vertical cañons down through the earth's surface. The *Transhimalaya* was not in sight on account of the rain. Though the *Satlej* is quite close to our left, it is not visible, but we see its winding gorge with nearly vertical rocks. Beyond *Tsaldöt-la* the road may be about 200 m. above the river. The ground is rocky or full of gravel and blocks, and sometimes we have real abysses to our left. The first pass is 4,495 m. high, the second one is 4,535 m. From the latter we have a fine view of the slightly winding *Satlej*

valley down to the green meadows of *Chung-lung*. From the second, *Tsaldöt-la*, the road goes down by a real labyrinth of ridges, crests, deep furrows and small valleys. Sometimes we go both on the left and the right side of the same ridge, in both cases with deep valleys on the sides. These valleys were now dry, and they are very short.

From the pass we have a slope of nearly 300 m. down to a little patch of even grass-covered ground on the right bank of the river, where *Camp CCCCLXII* was pitched, just below the rocky gate by which the *Satlej* comes out of its narrow gorge. The river is here in one compact mass of brownish grey water rolling in foaming waves in the middle of the course. The velocity might be 3 m. and the breadth 50 or 60 m. There are no rapids in sight. Our guide said that if it had been possible to cross the river here, we would have had a comfortable road on the left side the next day. Just east of the first *Tsaldöt* Pass, the living rock consisted of greyish white fine-grained quartzite. Between the two thresholds we had grey or yellow fine-grained limestone. On the way down from the second *Tsaldöt* Pass, the rock again was yellow quartzite with patches of rust.

On *August 4th*, our road goes S. W. for 7.5 km. only descending from 4,268 m. to 4,259 m., or 9 m. on this stretch which is only 1 m. in 833 m., being a very gradual fall. In the course of the afternoon, the river fell 3 cm., but during the night it rose nearly 7 cm. These oscillations chiefly depend upon the rain. The day's march followed the river closely. By a little gorge, the path goes up to a mostly natural, very narrow and sometimes dangerous cornice, in the solid rock. It goes up and down, out and in along projecting spurs and into small gorges and is sometimes very steep. Sometimes it passes the slippery planes of the strata and is, as a rule, some 60 m. above the river. The rock is a folded white fine-grained quartzite and grey or reddish limestone. Just above the bridge it consists of yellowish calcareous sinter and greyish white quartzite. At the bridge there is a low ridge of white crystalline granular limestone, which is cut through by the river, the strata forming an anticlinal.

From the first difficult passage of this road, we go down to the neighbourhood of the river, leaving a few small wild and rocky gorges to our right. Here and there are the remains of fluvatile terraces of pebbles and shingle alternating with sand and clay, all in horizontal layers and deposited by the river at an earlier epoch. They often form lists, borders and edges and bands of different colour, and are sometimes undermined by the river. Along the left bank, the highest are seen at some 70 or 80 m. above the river. For a while, the path goes along the base of the right terrace which is cut through by ravines. Occasionally there is a little even belt left below them, with grass. At the left or southern side of the *Satlej*, there is a comparatively broad valley coming out, in the mouth of which barley is

cultivated. Below it on the same side, two or three larger *manis* have been built. Then the river is pressed together to a very narrow stream of water which rushes down through its rocky bed with tremendous foaming and roaring and in a series of white, boiling rapids. At the wooden bridge, the river is only 13.1 m. broad. A short distance below the bridge the *Satlej* again becomes broad and comparatively shallow and the velocity is slow. At the right bridge-head, there is a red *chorten*. The monastery *Chung-lung-gompa* or *Kyung-lung*, is built at about 100 m. above the river on the top of a terrace, the sides of which have been modelled out in a most fantastic way by the rain and erosion. The location reminds one very much of the monastery of *Lama-yuru* in *Ladak*. Below the *gompa* there are several *chortens* and *manis*. Several grottoes and holes in the terrace walls seem to have been used as dwelling places. A little below the bridge we camped on a meadow at the left bank, some 20 m. above the river.

On *August 5th*, we travelled 21.3 km. south of the *Satlej*. Our *Camp CCCCLXIII* at *Chung-lung-gompa*, was at an altitude of 4,259 m., *Camp CCCCLXIV* was at 4,270 m. Between the two, we crossed a pass, *Munto-mangbo-la*, of 4,534 m. From our meadow we went down to the river, leaving the *gompa* to our right and 5 tents to our left. For an hour the road follows along the left bank. The *Satlej* is here imposing, working its way between steep hills and sometimes there is hardly room enough left for the road. Small transverse valleys enter from both sides, springs are numerous and the ground occasionally swampy. We reach a point where the river again enters a very narrow gorge between perpendicular and partly overhanging rocks. The whole mass of water presses against the left side and forces the path to leave the course of the river. We, therefore, ascend the hills to the left of the *Satlej*; it goes steeply up to a considerable height, the gorge of the river is seen deeper and deeper below our feet, and the distance from it increases. We ascend higher and higher. Finally we reach the flat and gravelly secondary pass, *Munto-mangbo-la*, at 4,534 m. Near it, several cairns were built. From here the gorge of the *Langchen-kamba*, as the *Satlej* is called by the Tibetans, is seen like a deep cañon in the earth's crust, but not the river itself.

From the pass the slope down is gradual. A series of cairns is passed again. From the last one of these, the descent becomes very steep down to a deep-cut valley where the height is 4,342 m., or nearly 200 m. below the pass. This tributary from the left or south to the *Satlej*, is like a cañon, and receives several small tributaries from the right; it contained a little brook generally flowing below the gravel in the bed.

The path then follows the bottom of this valley up towards the second pass of the day, being 4,483 m. high, and also marked by some cairns. At a short distance from it, we have more dominating peaks both to the north and south.

Then the ground is very even and overgrown with some vegetation. Suddenly one again stands at the edge of a new cañon furrow, sharply marked in the ground and more than 100 m. deep. Therefore, we have to go down to its bottom, where the height was 4,369 m. It did not contain any water now. At its left side we have to ascend exactly as much as we had just descended. On the left edge, there was again a cairn. Our direction, which hitherto has been W. S. W., now becomes S. 25° W. on the ridge between the cañon valleys. The top of this ridge forms a plain which, to the naked eye, seems to be perfectly level, though it falls slowly towards the valley of the *Satlej*.

After a march of about 2 km. on this even ridge, we again reach a very deep and energetically eroded cañon with a considerable river coming from S. 12° W. and called *Shib*. It joins another river a little lower down, called *Lunak*, and coming from S. W. The joint river, *Shib*, then goes down through a narrow gorge to the *Satlej*, its course being N. W. The *Shib* valley was here 243 m., cut down, as at the edge of the plateau at its right side, the height was 4,513 m. and in the bottom of the valley 4,270 m. The name of the place was said to be *Kande*. At a distance of two short marches to the south and S. W., a black mountain range was visible with some snow peaks of no very great altitude.

Pan. 548, Tab. 105, is a little sketch of the *Shib* valley to the N. 44° W. A little below *Camp CCCCLXIII*, the living rock is black schist; then, along the *Satlej* to the beginning of the gorge it is yellow, fine, crystalline limestone alternating with quartz schist; the same rock prevailed up to the neighbourhood of the first pass. In the deep valley west of *Munto-mangbo-la* the living rock is black phyllitic schist, which then seems to prevail the whole way to the camp.

We were accompanied part of the way by a Tibetan yak caravan loaded with tea. No other human beings were seen, and of animals, only 12 *Ovis ammon*.

On *August 6th*, we proceeded 19.8 km. west, N. W. and north. At *Kande* we were at 4,270 m. and at *Camp CCCCLXV* at 4,396 m. The river *Shib*, *Ship* or *Shibe-chu*, at the right bank of which we had camped, was now 22 m. broad, had an average depth of 0.35 m., and an average velocity of 1.5 m. The volume of water was thus 11.5 cub. m. per second or 12 cub. m. together with a little side branch. It had not rained the last days, otherwise this river would have been considerable. Then we cross the terrace between the *Shib* and its left tributary for which we could not find any name. The terrace corresponds with the lowest or 10 m. terrace we had seen before. On the top of it were a few ruins of houses. The tributary was crossed after we had come down from the terrace; its dimensions were: breadth 9 m., its average depth 0.25 m., and its velocity about 1 m., the volume thus being 2.3 cub. m. per second. Its water was perfectly clear, whilst that of the *Shib* was as muddy as in the other tributaries. We had so far measured

191 cub. m. per second for the whole *Satlej*. In this figure, however, the tributaries on the opposite side are not included, nor small brooks from springs. The volume is, therefore, greater.

As usual, the ascent begins at once and is very steep. To the right is seen the narrow gorge by which the joint *Shib* River goes down between wild rocks and nearly perpendicular terraces to the *Satlej*. Our road traverses three terraces, crosses a tributary bed and ascends a valley. On the platform of the hills, there are many erosion furrows. Turning N. W. we enter the large valley, *Sang-serpo*, with hard soil and some scanty vegetation. Here the solid rock consisted of dark-green serpentine. To the left are ridges and hills and from them a large tributary valley enters. Finally our direction becomes due north and the valley is somewhat broader. In its northern part, it again becomes very narrow. Here a spring comes forth, forming a little brook surrounded by good grass. In the first part of our march the black range, south of our route, was still visible at a distance of perhaps 20 km. and with snow here and there.

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## CHAPTER XXV.

### TO THE FRONTIER OF BRITISH INDIA.

On *August 7th*, we travelled 11.5 km. N. W., sinking 315 m. or from 4,396 to 4,081 m., being a rate of 1:36. The day was rainy. The road continues down through the valley, now narrow as a gorge between steep rocks of the same dark-green serpentine as before. Now and again the little brook is crossed. After a short distance, the valley turns to the right and becomes broader. The path leaves it and ascends the hills to the left. On the top of this new bit of the platform, we cross an erosion furrow and after a while, stand again at the edge of a deep valley to which we have to descend. Its slope is comparatively steep to the N. E. and north. It is partly very narrow between rocks of solid material. The rocks consist of yellow and red jasper and quartz. From the right a tributary valley joins it, and the joint valley falls to the west and has a little brook from a spring in its bottom. At several places are cairns, *manis* and ruins of old houses. From the south or left, a third valley joins the one we are following; it is deep-cut, wild and winding, and changes our direction to the north and N. N. E. From the road on the edge, the view of this valley is very picturesque. The rainy weather does not allow a distant view, but still one suspects the mighty valley of the *Satlej* to the north. On a lower terrace and slope, the ground is green with barley fields. *Dongbo-gompa* becomes visible. On the sides of the valley, living rock occasionally crops out, the rest being terraces of pebble and shingle modelled in the most picturesque way by rain and erosion. The way down from the edge of the platform is very steep, between hills and small ridges and in ravines and small valleys. According to the aneroids, we descend 180 m. in this short distance, the fall being at a rate of about 1:8. The *Dongbo* River down in the deep valley, was 13 m. broad, had an average depth of 0.3 m., an average velocity of 1 m. and an approximate volume of 4 cub. m. per second. Just below the *gompa* the rock was brownish red jasper.

On *August 8th*, our road goes 8 km. N. W. From our camp at *Dongbo-gompa*, where the height is 4,081 m., we ascend directly to the top of the flat, open country again, at the edge of which we are at 4,437 m. We have thus ascended



356 m. in a distance of 1.8 km., or at a rate of 1:5. These figures, if compared with those from the plateau-land of *Chang-tang*, give a very graphic idea of the morphological difference between the two. Looking N. W. from the top of these platform-shaped blocks between the tributaries, one gets the impression of a nearly even country, the surface of which slopes only very slowly towards the *Satlej*. Through this apparently so even and comfortable land, the southern tributaries of the *Satlej* have cut down their valleys like cañons to a depth of, as in the case of the *Dongbo*, 356 m., with very steep, sometimes nearly perpendicular slopes on both sides. From *Dongbo-gompa*, the road goes in an endless series of zigzags through small valleys and ravines between hills and ridges up to the top or the general surface of the country, which in this way has been carved out by a very energetic erosion.

Three new furrows are crossed, the third considerable and directed to the N. N. W. None of them contained water. There is no grass, only some scarce steppe vegetation. The soil consists of fine gravel. To the N. 25° E., there is a flat snow-covered peak on the *Ladak Range* which separates the valley of the Upper *Indus* from that of the *Satlej*. To our left, or S. W., there is a range of moderate height, the continuation of the one mentioned above. This is obviously the *Saskar Range* belonging to *Great Himalaya*. After a tiring march up and down, we again suddenly behold a new, deep, wild valley of much the same sort as the *Dongbo*, and at the side of precipices, we again go directly down to its bottom. The river, called *Yungu-tsangpo*, now occupied a very little part of the gravelly and sandy floor of the valley. Only 1 km. above the road the river comes out as from a rocky gate, where its narrow gorge widens out into the broader part of the valley crossed by the road. The *Yungu-tsangpo* was now 18 m. broad, had an average depth of 0.4 m., an average velocity of 1.4 m. and a volume of 10 cub. m. per second. So far, we had calculated about 205 cub. m., though the *Satlej* here certainly carried 300. On the left side, were barley fields and ruined houses. At *Camp CCCCLXVII*, the absolute altitude was 4,068 m., or only 13 m. below the previous camp. The rock was greenish jasper.

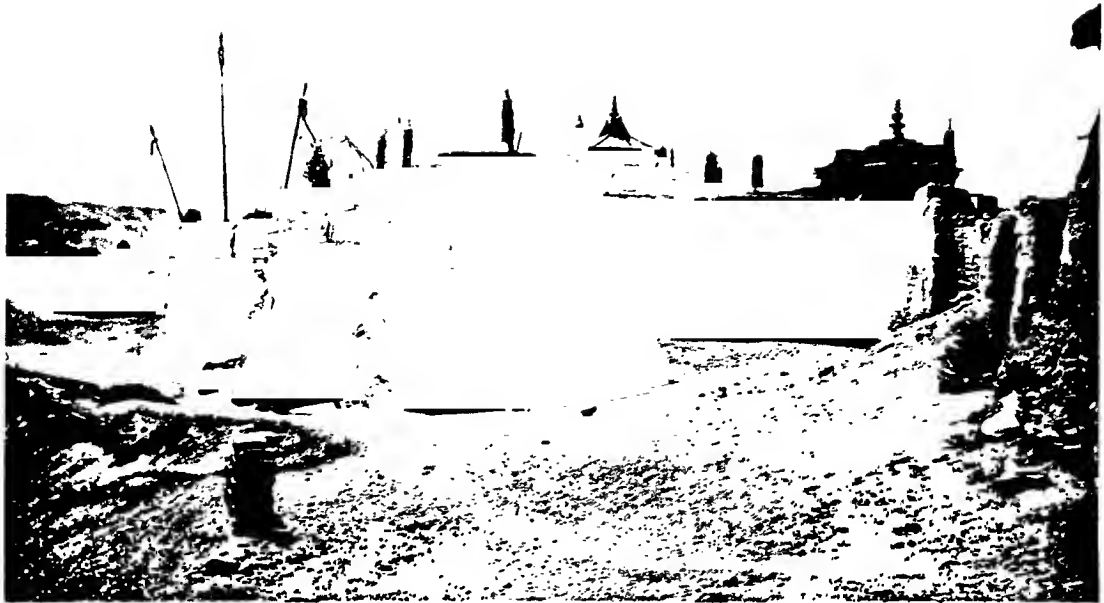
On *August 9th*, we travelled 18.5 km. to the west and N. W. At *Camp CCCCLXVII* we were at 4,068 m., on the top of the next block at 4,418 m., the rate of the rise being as 1:9, the distance between the camp in the bottom of the *Yungu Valley* and the edge of the platform being 3.2 km.

From the valley one first ascends two terraces about 25 m. in height; on the top of the uppermost there are barley fields, also arranged as terraces with small irrigation canals and low earth walls. Then the steep rise begins again. A little to the left, are two small, rocky spurs with ruins of houses and walls. Finally we are at the top of this new stiff ascent, with, as usual, a cairn just at the edge. Then

follows a bit of even ground or *tanga* in Tibetan and *maidan* in the Mohammedan languages. The evenness does, however, not last very long, for we have to cross four or five erosion furrows, one of them very considerable and taking much time. Our direction which so far has been to the west, now turns to the N. W. Four new erosion beds are crossed. Immediately to our left a very deep-cut valley appears, and to our right, a tributary to it. From the point between them, the view is magnificent. It is seen on Pan. 547, Tab. 104. To the left and right it shows the two, not very high, ranges which border the *Satlej* valley to the S. W. and N. E. Both have small snow patches here and there. The one to the left is somewhat nearer. The large tectonic valley between the two, is filled with loose material, though living rock also crops out here and there. The panorama shows how very slowly the surface of these deposits slope towards the *Satlej*, which, however, is not visible, only suspected. The valley just to our left, goes down and forms a right tributary of the *Daba*, which is a valley of the first order, and the perspective of which is seen in the middle of the panorama. A little farther on, the *Daba-gompa* is seen on its terrace on the beds of pebbles and shingle and on the slopes and bottom of the little side valley at its foot, the village of *Daba*, surrounded by a most picturesque and fantastic landscape of pyramids cut out in the left terraces of the valley.

From our observation point, we go down along the steep slopes at the right side of the tributary, crossing several small beds and furrows. The tributary is crossed by the road and a new projecting spur has to be traversed. At its edge is a cairn, from which the road is very steep. On the lowest terrace, there is a *mani*. The river is divided into several branches, being together about 30 m. broad, 0.15 m. deep and with a velocity of nearly 1 m., the volume of water amounting to about 4.5 cub. m. per second. From the last cairn to the bottom of the *Daba* valley, the descent was 256 m. From the highest parts of the day's march we had a general view of the country to the right of the *Satlej*. At this distance, it is impossible to compare the northern tributaries with the southern. But as the road goes south of the river, it would seem that the ground here is more comfortable. If this be the case, it could only be due to the northern tributaries being larger, with steeper slopes and more water than the southern. At *Daba*, or *Dava-gompa*, the following passes were mentioned as leading over the *Ladak Range*, N. E. and north of this part of the *Satlej*: the *Ayi-la*, the *Sergo-chen*, the *Pögö-la* and the *Laoche*.

Pan. 546A and B, Tab. 104, gives a view chiefly of the left side of the valley, with its steep and partly perpendicular slopes as they have been cut out by the river in former times, and as they have been modelled by later erosion. To the N. 27° E., the *Daba* valley continues down to the *Satlej*, and in the background are seen the peaks of the *Ladak Range*.



DABA-GOMPA. (CP. VOL. II; P. 162,  
WHERE THE SAME MONASTERY IS SEEN FROM BELOW,  
FROM THE VILLAGE OF DABA.)



The next day's march, *August 11th*, takes us 13 km. N. N. W. The starting point is at 4,177 m. and the end point at 4,089 m., giving a general fall of 88 m. or at a rate of 1:148. But as hitherto, it is not a continuous and regular fall, it goes up and down the whole way. Our road enters a little tributary valley taking us S. W., west and N. N. W. The latter direction begins in a gorge, sometimes only 2 or 3 m. broad, cut down between perpendicular walls and pillars of pebbles and shingle of considerable height. The ascent of this gorge is extremely steep, as steep as is possible for laden animals to climb. Its floor consists of fine, yellow loess-clay which must be very slippery and difficult during rains. This sort of valley is what the Tibetans call a *rong*. The valley leads to a threshold which is about 200 m. above the floor of the *Daba* valley. On the other side we enter a comfortable valley with a fall to the N. N. W. It joins another larger valley with a brook falling N. N. E. From the bottom of the latter, we again rise to open country, which, however, does not last for long, for soon we have to cross a new tributary of the *Satlej*, comparatively broad, with grass and a little brook. In the next tributary are the ruins of houses and several *chortens* a short distance below the road. Barley is cultivated, and a little canal has been dug from the brook originating from a spring. Then follows a labyrinth of hills separated by ravines and a narrow valley, cut through loess-clay. At a certain section of the road, a system of erosion furrows begins, just where the road passes; to the N. N. E. one sees how they gradually become deeper, join one another and go down to the *Satlej*. The next valley we have to cross, is directed to the N. 40° E. but gradually turns more to the left. The road down to its bottom is so steep that the loads glide over the heads of the pack animals. In its bottom, there is a brook and some grass.

On its other side we have, again, to ascend to the top of a new block, separating the valley from its next neighbour, which was said to be called *Manlung-karla*, and where we camped near a spring of +9.7°. The poor natives of this place expected that their barley would be ripe in another six weeks. They told us that the little pass above *Daba* was called *Shangtso-la*, and the two valleys with brooks were called *Kasar* and *Geto*.

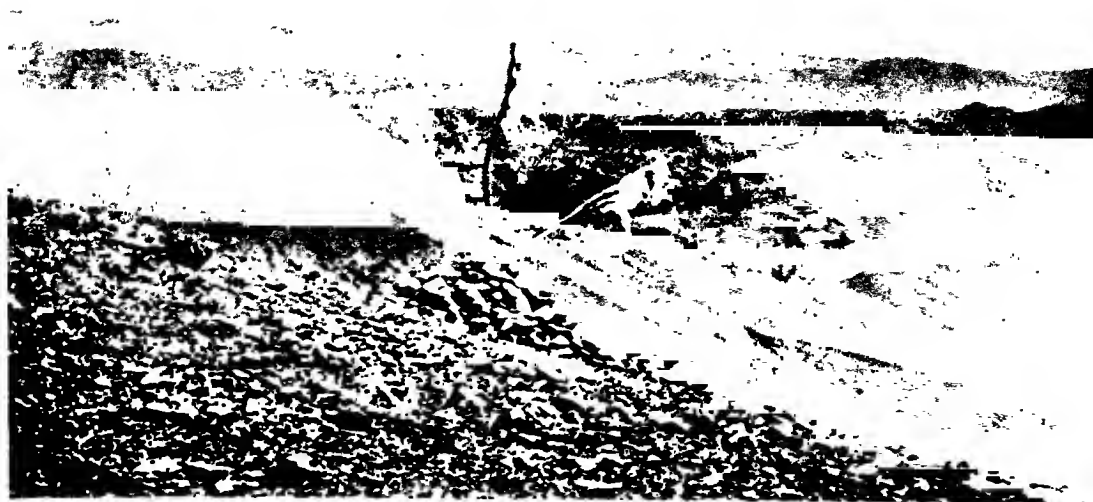
On *August 12th*, we made 9 km. W. N. W., descending to 4,016 m. or 73 m., being a rate of 1:123. From *Manlung-karla*, the road, as usual, ascends very steeply to the platform of the next block. The ground is loess-clay, very slippery after the last rain. On the sides, are walls of pebbles and shingle. After 2 km. it goes again straight down to the bottom of the valley *Anggong*, the road zigzagging between pillars and pyramids of pebbles and shingle as hitherto. There is grass and a brook in the deep-cut and narrow valley which soon joins the *Mangnang* valley. The road turns a right angle around a corner, and our direction becomes W. S. W. *Mangnang-gompa* becomes visible, surrounded by a little grove of poplars.

The river of the *Mangnang* valley was divided into several branches, the joint breadth of which amounted to 66 m., the average depth was 0.25 m., the average velocity 1.2 m., and the volume about 20 cub. m. per second. So far, we had controlled 230 cub. m. of water to the *Satlej*. On the left side are meadows, and here the *gompa* is situated. The village consists of 3 or 4 houses with walls, and the barley fields are larger than hitherto. The harvest would take place in a month. Ten days before, *i. e.* August 2nd, the *Mangnang-tsangpo* had been very swollen and difficult to cross. The river was said to come from a mountain, *Gangmen-gangri*, 2 or 3 days S. W. The real name of the monastery was given as *Mangnang-Changchughling-gompa*.

On *August 13th*, we travelled 21 km. N. N. E. and N. W. Here at last we got a means of determining how great was the difference of altitude between a part of our road in the bottom of a tributary, and the *Satlej* itself. In the valley of *Mangnang*, the height was 4,016 m., and at *Totling, au niveau* with the *Satlej*, it was 3,700 m., or 316 m. lower. In this distance of 21 km., the rate of fall was, therefore, as 1:66, disregarding the accentuated relief of the surface. We may, therefore, approximately, fix the fall of the lower parts of the southern tributaries at 1:66.

Just below the monastery, the ascent begins, and is here moderate. We ascend three terraces of older date, and cross several ramifications and flat hills, falling steeply to the south and with a more gradual slope to the north. Finally we reach the edge of a very wild and picturesque cañon valley, which seems to be some 300 m. deep. To the north and N. W. of it, we behold a whole system of valleys of the same kind, a most accentuated and capricious relief and a typically cañon-shaped morphology. It is, of course, absolutely impossible to go down from the edge to the bottom of this valley. The road, therefore, follows the very edge for about 2 km. Looking in the direction of the road, one sees the slope in profile. The surface of the protuberance on which we are riding, is nearly horizontal, and consists of reddish brown gravel. This uppermost layer is here 5 or 6 m. thick, and towards the valley it is cut off vertically. The underlying layers appear in different colours and of different consistence. Some are light grey or green, others somewhat darker. Where the material is comparatively solid, for instance pebbles and shingle, the outer side is vertical; where it consists of soft sand, it has a steep slope.

The landscape is one of the most picturesque and magnificent I have ever seen. At a point where the slope is more moderate and where the customary cairn is built, the road goes down the precipice. Here the loess-character is obvious. The road winds in all directions, sometimes through gorges 2 or 3 m. broad and 30 m. deep, cut down in the loess deposits, and extremely steep, sometimes on cornices or galleries along the loess wall with an open view to one side, except where blocks, pillars or pyramids of clay are left. Occasionally, one has to go nearly a



THE SATLEJ CANYONS.





complete circle to reach a suitable passage, allowing the road to descend a bit, or it proceeds on the top of a clay ridge with deep-cut ravines on both sides. The majestic *Satlej* is in sight. On a last flat hill to our right, there is a cairn with poles and rags. Here *Totling-gompa* is visible, like a little square town on the left bank of the *Satlej*. Just below the monastery, our *Camp CCCCLXXI* was pitched. The old historical *Tsaprang* was said to be inhabited by only 16 individuals, most of them occupied with their barley fields. There was a *dsong* which is in function only two months every winter, and for the rest of the year is placed in another village. There is a road from *Totling* on the left side of the *Satlej*, passing by *Tsaprang* and continuing N. W., but it was said to be more difficult than the one I took on the right side of the river.

On *August 15th*, we travelled 17 km. E. N. E. to the passage of the river, and thence N. W. to *Camp CCCCLXXII*, where the height was 3,746 m. From our *Totling* camp, we again ascend the terrace on which the *gompa* is situated and march east and N. E. and finally north down to the bridge. The *Satlej* is here pressed together in a rocky passage, only about 25 m. broad and very deep-cut in greyish green or yellowish brown sandstone, where the water is roaring with furious force. Just below the bridge, the river again becomes broad and more quiet. On the right bank we turn westwards, along the river, up and down amongst ravines and small hills of gravel and yellow clay. Here we cross the valley which was said to come from *Ayi-la*, and which now carried about 5 cub. m. per second of muddy, yellowish water. With the lowest terrace to our right, we then march in the very bed of the *Satlej*, where there is space enough for meadows. Finally we leave the *Satlej*, ascend the terrace, and enter the *Natang* valley, bordered with cañon walls of clay, sand and pebbles and containing a brook of about 2 cub. m. per second. At a place with some grass, the camp was pitched. At 1 o'clock p. m., the brook began to swell to about 20 cub. m. per second, obviously from a heavy rain somewhere in its upper reaches. Pan. 549, Tab. 105, is a sketch of the *Natang* valley down to the S. 19° E.

On *August 16th*, we made 16 km. north, gradually ascending from 3,746 m. to 4,085 m., or 339 m., being a rate of 1:47, or somewhat steeper than along the southern tributaries, as measured on the road to *Totling*. The first two hours, the march was difficult; after the rain the clay ground was more like a bath of mud, and we had, several times, to cross the furrow with its 1 or 2 m. high erosion terraces; in the bed a brook of very muddy and thick water was winding. The main valley, from which most of the water came down, was left to our right. The valley has a very pronounced cañon character and is nearly barren. The slopes on the sides are very steep, often perpendicular and sculptured in fantastic relief, resembling more or less detached blocks, pillars, towers and pyramids. From the

sides, innumerable ravines enter, being only about one foot broad, 2 or 3 feet deep and vertically cut down in the loess ground. Often they appear in whole systems close to one another. Their edges are softened by the rain and gave way under the weight of the horses. The valley is narrow, sometimes like a gorge, where one has to march in the muddy bed itself. Sometimes it is broader. Here and there the ground consists of fine gravel or coarse sand. The height of the hills to our sides, decreases. At some places solid schist crops out at their base. Finally the valley turns N. W. and in its background, higher, rounded hills appear. At a spring and some grass and bushes, we made *Camp CCCCLXXIII*. Pan. 550, Tab. 105, is a view to the N.  $50^{\circ}$  W. from this place. The living rock in our valley consisted of greyish black schistose limestone.

On *August 17th*, we marched 20.3 km. N. N. W. and N. W. In the first 1.3 km., we rise 191 m. or to 4,276 m., a rate of 1:6.8. In the whole distance to *Camp CCCCLXXII*, the rise is 109 m. or 1:186. The short distance up to the edge or threshold with the usual cairn, the valley has the same appearance as before, between its walls of loose material, and with small tributary valleys entering from the sides. Reaching the very head of the valley, the landscape changes its appearance at once and completely. The cañon character with vertical lines comes to an end, and slowly rising, slightly undulated forms begin; the landscape becomes open, the ground consists of hard, fine gravel, and there is high, though scarce, grass. Several ravines and shallow beds are crossed. The name of the region is said to be *Kalingtang*. To our right is a mount with three peaks. The road is readily visible as two or three paths on the ground, and here and there are cairns or small *manis*. From a dominating height with a larger cairn, we have a far-reaching view to the N. W. across innumerable cañon valleys, of all dimensions down to the smallest ramifications and insignificant beds. To the west and N. E., snow-covered mountains are in sight. The last part of the day's march took us through one of these cañon valleys with nearly vertical formations of loess and pebble and shingle at the side. This valley joins as a left tributary, the larger *Shangdse* valley which comes from N.  $55^{\circ}$  E. and goes S.  $25^{\circ}$  W. so far as can be seen.

On the left side, the ground is swampy and there are barley fields and the village, *Shangdse*, of some 50 common Tibetan mud and stone huts. The *gompa* of the same name is situated on the right side, perhaps 100 m. above the valley.

On *August 18th*, we marched 13.5 km. N. W. The end point is situated 28 m. below the starting point, the former being at 4,166 m., *viz.* *Camp CCCCLXXV*. But before reaching this camp, we have to ascend a point at 4,486 m., or 320 m. higher. From this point to the camp, 3.3 km., the descent is, therefore, as 1:10.3. Leaving the village to our right, we cross the river which now had the following dimensions breadth 17 m., average depth 0.3 m., velocity about 1 m., and volume, approximately

5 cub. m. per second. On its other side, the road enters a gorge just to the right of the *gompa*. The valley rises to more open and undulated ground of gravel and sand. A flat threshold opens the view to the next valley to which the descent is gradual. Its name is *Choktse*, higher up, *Surkang*. The valley has a brook and is comparatively broad. Barley is cultivated. The natives have also sheep and some cattle, but no yaks. They are agriculturists not nomads. In the course of the day, some of the common highland animals were seen, as kyangs and marmots.

N. W. of this place, we have to traverse a new protuberance of loose deposits before we reach the next valley, which is a small tributary to the *Choktse*. From this valley we have to ascend to the pass of 4,486 m., after which there follows a bit of undulated ground, from which we behold the monastery of *Rabgyäling-gompa*, situated, like the previous ones, on a hill on the right side of the next valley; at the foot is the village of the same name. The brook of the valley now had clear water, indicating that no rain had fallen in its area the last days.

On *August 19th*, we travelled 13.2 km. W. N. W., rising from 4,166 m. to 4,300 m. or 134 m., being a rate of 1:98. The same morphological features, as usual, prevail. The road goes up steep hills, leaving to its right a deep-cut gorge, on the other side of which the *gompa* is situated on the top of its dangerous terrace of pebble and shingle. On the top of the next protuberance, the road is comfortable between clay hills, in ravines and along cornishes, but soon it again goes down to a considerable valley with houses and barley fields on both sides of the road. This extensive valley, directed to the S. W., as usual, is called *Rildigyok* in its upper course and *Chang-tang* in its lower. From its little brook we ascend the next protuberance, the road being as steep as on the eastern side. On the top of this protuberance we have to cross several deep and wild ravines, tributary to *Rildigyok*. Two of them were comparatively large and took time to cross. *Camp CCCCLXVI* was pitched in a valley called *Karu-sing* with grass and a spring, but no inhabitants and no cultivation. This valley forms a shallow depression in this plateau-land.

On *August 20th*, we had 10.8 km. to accomplish in a W. S. W. and S. W. direction rising from 4,300 m. to 4,478 m., or 178 m. being at a rate of 1:61. We were at a considerable height and in the nights, the temperature was very near the freezing point. But we also were at a considerable distance from the deep valley of the *Satlej*. Only along the large river, there is a constant fall towards *India*. On our road we have to cross all its northern tributaries and the protuberances between them. Therefore, it is continually up and down, and never a plain or a *maidan* gives a rest. One has hardly crossed one of these tributary valleys, when the next appears at a short distance. Therefore, the road becomes twice as long as it is, as the crow flies. And the interminable ascents and descents are very fatiguing to the animals. The valleys are chiefly cut down through deposits of clay

or loess, though on the heights and in shallow valleys, gravel began to be more common. On the road to *Camp CCCCLXXVII*, living rock cropped out at the sides of small valleys, being on the first half of the road, greyish dark dense limestone as hitherto, and with a yellowish tint if weathered. As a rule, the strata are very folded.

At the left side of a valley of moderate size, there is a little monastery, *Sumur-gompa* and two or three huts. *Ldat* is a right tributary valley to it. In the latter, we camped at a spring surrounded with grass. From *Camp CCCCLXXVII*, the view is far-reaching across the enormously accentuated and wild country to the N. E. and E. N. E., a labyrinth of deep-cut valleys coming down from the partly snow-covered *Ladak Range*, as shown on Pan. 551, Tab. 105.

On *August 21st*, we had a piece of road more accentuated and fantastic than ever. We made only 11 km. on the map —, in reality much more —, as the line is very undulated both horizontally and vertically. In the first 2.6 km., we rose 179 m. to the pass, *Dato-la*, 4,657 m. high, being a rate of 1:14.5. In the next 3.8 km., we sank no less than 830 m. or to the bottom of the valley of the *Ngari-tsangpo*, where the absolute altitude is only 3,827 m. On this section of the road, the fall has the enormous steepness of 1 m. on every 4.6 m. On the third section of this road, which is 4.6 km. in length, we ascend from 3,827 m. to 4,351 m. or 524 m., giving a rate of 1:8.8. These figures give a very good idea of the profile of this extraordinary country.

From *Camp CCCCLXXVII*, the road thus takes us up to the pass, *Dato-la*, from where we have a magnificent view of the valley of the River *Ngari-tsangpo*, enormously deep, cut down in solid rock, surrounded by the most picturesque landscape in all directions, with tributaries, and tributaries of tributaries, from the smallest ravines to large valleys joining the *Ngari-tsangpo*. From the cairn at the edge, the road seems to disappear in a vertical abyss. It runs down along the sides of the mountains, through narrow gorges, across projecting spurs. It took us one hour and a half to reach the bottom of the valley. At a period with heavy precipitation, the river has cut down its course with such force and in comparatively so short a lapse of time, that the weathering and destruction of the mountains at the sides have not been able to follow. Therefore, the sides of this river, from the edges of the plateau and down to its bottom, are so steep. *Optil* is the name of the natural bridge which has been formed by two or more enormous blocks fallen down from the slopes above. The river literally disappears under them. A fissure of 2 m. breadth is left open between the blocks and spanned over by a little wooden bridge, perhaps 25 m. above the river.

The river comes from N. N. W. So far as the eye reaches, it is as wild and narrow as here. It drains the district of *Chumurti* and the country south of the

pass opposite *Tashi-gang*. The view of the river must be magnificent after hard rains. Now, in its neighbourhood, it is impossible to get a drop of water; certain stretches one does not even see the river. Under the bridge its breadth may be only 5 m. The water is, therefore, much deeper than it is broad. Lower down, there is a more comfortable passage of the *Ngari-tsangpo* at a place called *Op*, but its bridge had been destroyed.

On the other side, the ascent is not quite as steep as on the left. But it is hard work to climb to the top of the next protuberance. In a little valley with springs and grass, being a tributary to the *Ngari-tsangpo*, we made our *Camp CCCCLXXVIII, Koldoktse*. The living rock on this road consisted of oolitic limestone, phyllitic schist, brownish yellow calcareous sandstone or sandy limestone, and dark grey phyllitic calcareous schist.

On *August 22nd*, we made 19.4 km. W. N. W. The first 2 km. to the pass, *Dambak-la*, we rise from 4,351 m. to 4,601 m. or 250 m., at a rate of 1:8. On the next section, from *Dambak-la* to the bottom of the *Saser* valley, we sink 279 m., or to 4,322 m., being at a rate of 1:5.4. The next section, to the pass *Pooche-la*, is 6.2 km. in length. The pass being 4,927 m. high, the rise is here 605 m. or at a rate of 1:10.2. The last section is 9.6 km. in length, and here the ground falls 178 m. or to 4,749 m. at *Camp CCCCLXXIX*, being the more moderate rate of 1:54.

From *Camp CCCCLXXVIII*, the ground continues to rise to *Dambak-la*, from which the slope is very steep down to the valley of *Saser*, directed to the N. E. and having a brook. The road that follows its left tributary, *Tsang-langma-kesa* or simply *Kesa*, also has a brook and is very steep. The grass is good. The road soon leaves this valley and goes up steeply between rocky spurs and hills of the region, *Sanek*, in a W. N. W. direction to the flat pass, *Pooche-la*, with a cairn at a height of 4,927 m. On its other side the fall down through a valley between rocks, is gradual. Its relief becomes gradually more and more pronounced. It has a brook, and a wider part of the valley was called *Manchu-chen*. The road chiefly sticks to the slopes of the hills to the left. A right tributary valley carries some water. A left tributary was called *Sumbu-tar*. In the little valley, *Bichutse*, we camped near a spring amongst grass. The ground here, everywhere consisted of gravel and coarse sand. At the right side of the *Saser* valley, the living rock was white and grey limestone; the same rock prevailed at *Pooche-la*; in the valley west of the latter, we found dark grey schist with veins of limestone.

On *August 23rd*, we made 13.2 km. to the W. S. W. The country was less accentuated than the day before, but the altitude everywhere, considerable. At the starting camp, *Bichutse*, we had 4,749 m., and at the end camp, *Lungun*, 4,753 m. On account of the height, the temperature again became low, this night for instance  $-1.4^{\circ}$ . From the camp the road goes up to a little threshold, 4,861 m. high, from

where it sinks to the *Chuvang-chung* valley, the brook of which joins a larger brook called *Gyäsövang*. From the latter our road ascends to the little pass, *Piang-la*, 4,790 m. high. The way down from this pass crosses a series of hills and ravines, and has small ridges to its left. To its right is the river, *Tokchen-chu*, flowing to the N. N. E. This valley and its brook come chiefly out of a considerable range N. W. of our route, which seems to stretch to the W. N. W., and has some snow on its higher peaks. This range has a large number of transverse valleys with brooks and grass and directed to the *Tokchen-chu*. In the *Lungun* valley were 4 poor tents, a brook and some grass. Just here the valley *Närib-ke* coming from the S. W., joins our valley. The rock consisted of black, brittle limestone.

On *August 24th*, we travelled 17.2 km. S. W. The first 7.6 km. took us up to the pass, *Dungmar-la*, 4,858 m. high or 105 m. above *Camp CCCCLXXX*, giving a rise of 1:72. From this pass we had 9.6 km. to *Camp CCCCLXXXI* where the altitude was only 3,778 m. or 1,080 m. below *Dungmar-la*. Here the rate of fall is 1:8.9. In the night the minimum temperature was  $-2.8^{\circ}$ , the last temperature below freezing point on the journey, the next minimum being  $+8.9^{\circ}$ .

At *Lungun* there was a little nomad village with yaks and sheep. Leaving it we ascended the terrace and then had slowly rising undulated ground with shallow erosion beds. Immediately to our right is the brook, *Närib-ke*, and beyond it, to the west the pass, *Kongkong-la*, belonging to the above-mentioned partly snow-covered range, which reminded me very much of the *Surla Range* in the *Trans-himalaya*. A part of this range is seen on Pan. 552, Tab. 105, taken from *Dungmar-la* and is the last in my collection of panoramas.

The pass, *Dungmar-la*, is as flat as a plateau. It is adorned with a cairn with poles, rags and yaks' horns, everything painted intensely red. A *mani* with very well inscribed stones, starts from the cairn to the S. W. The view is beautiful. To the south and S. W. we see the range which we have to cross in *Shipki-la*, and just north of it, is the wild, deep-cut furrow of the *Sattlej*. To the west is a considerable valley with snow mountains in its background, and surrounded with grey, wild and rocky peaks, pyramids and pinnacles. From this valley a considerable tributary to the *Sattlej* comes out and turns south. Its name is *Tomlang-tsangpo*. On our route, *Dungmar-la* is a very important point as it may be said to mark the boundary between a country which still had a good deal of the *Chang-tang* character, whilst to the S. W., the morphology of the peripheric country exclusively, is pronounced. The pass also seems to be a boundary between the nomads to the N. E. and the chiefly agricultural villages to the S. W.

The district S. W. of the pass was called *Tagha*. We cross it from the pass; the slope down to *Tomlang-tsangpo*, is very steep. The ground is gravel, sand or fine dust, with some scanty vegetation. *Shing-chigma* is the name of a part of the

valley. We cross an irrigation canal going to the village, *Tangmet*, the fields of which are situated on a natural platform at a considerable height above the valley. Just below this village, the river is crossed on a wooden bridge.

The *Tomlang-tsangpo* had now some 10 cub. m. per second of nearly clear water, roaring between blocks in its bed. Just here, it receives a tributary from the west; in the near background of its valley is a rocky group without snow. On the right terrace of this valley, is the little village of *Pera* with fields, and several *manis* and *chortens* of the kind that are numerous in these regions. The road is bad and partly difficult. We climb the steep slopes on the right side of the *Tomlang* River. To our left is the nearly vertical fall down to the river. From a little threshold called *Puga-la*, the road finally goes in innumerable zigzags down to the little village of *Puge*, with its houses, fields and a few willows, situated on a terrace, like a platform, above the river. From here the road is like a cornice along the hills, and from a second little threshold, goes down to the village of *Yer*, with very extensive fields on the left side of a tributary valley from the right. *Mani* walls and *chortens* are numerous. The brook of the tributary valley carried some 6 or 8 cub. m. per second, and has a bridge. The living rock now consists of quartzite, mica-schist, gneiss and phyllitic schists, sometimes pierced with pegmatite and granite.

On *August 25th*, we made only 9.2 km. to the S. W., but in this short distance, we had to rise 395 m. to the 4,173 m. of *Rongtotke-la*, and thence to descend 1,191 m. to *Camp CCCCLXXXII*, the rise being at a rate of 1:13.7 and the fall being at the enormously steep gradient of 1:3.2!

Just below *Yer*, we pass the village, *Tsar*, also situated on a terrace with extensive cultivation. At the foot of a little hill with willows, is a monastery called *Shinggun-gompa*. Near it and a little higher, is the village of *Pude*. Then the road crosses the brook of a tributary with a bridge. From here the ascent begins. To our left is the village of *Niru*. We now have to cross the steep and mighty mountain spur that is projecting between the *Satlej* and its tributary, *Tomlang-tsangpo*, which we had followed since *Tagha*. Along both rivers, a path was said to exist, which could only be used by men on foot. On the top of *Rongtotke-la*, there is a *mani*. The view is magnificent. Below our feet is the majestic *Satlej* in its deep, narrow valley between wild rocks. So far as can be seen, the river here comes from the S. 35° E. where its deep, winding valley is seen between the mountains. To the W. S. W. the village of *Shipki* is seen with its fields. And beyond the village, the *Shipki-la* is visible in a very mighty ramification of the southern mountains. On the range of *Shipki-la*, there were only a few strips of snow. It takes a long time to go down the 1,191 m. from the pass to the right bank of the *Satlej*, where we camped on a meadow near the village and bridge of *Lopchak*. The latter is 7.9 m. above the *Satlej* and the river has here a breadth of only 22.45 m.

On *August 26th*, we travelled westwards from *Lopchak* to *Shipki*. On the left bank of the *Satlej*, the road goes on a cornice above the river for a short distance, until we reach a considerable valley from the south called *Rokchi-chu*, with a brook containing some 5 cub. m. of water per second. In this valley is the village *Chiri*. *Korang* is a village on the right side of the *Saltej*. *Tsamdo* is the difficult part of the passage with the cornice road and a *mani*. The road then continues at some distance from the river, crosses a deep tributary, and passes by the village of *Chok* with groves of trees and gardens. On its other side, we again go deep down to the little valley, *Largyäp*. The next villages, with cultivation, are *Yebu-pulsum* and *Lingchu-tanga*. One of the several *manis* was about 100 m. in length. *Salve-chu* is a very considerable valley from the south, with a bridge. Its brook had about 6 cub. m. per second. On its left bank, is the village of *Shipki*, and our *Camp CCCCLXXXIII*. This is the last village on the Tibetan side. On the hills of the right side of the *Satlej*, is the monastery, *Puri-gompa*.

On *August 27th*, we accomplished the last piece of road to and a little beyond the Indian frontier. The ascent to *Shipki-la* is not difficult, but stiff. It begins immediately from the village of *Shipki*, and the steepest parts of the slope are called *Tak-melong* and *Yayur*. The pass was said to be called *Pimig-la*, as well as *Shipki-la*. Its absolute altitude is 4,695 m. At *Lopchak*, we were at 2,982 m. The distance between the two, is 11.8 km., and the difference of height 1,713 m. From *Lopchak* to *Shipki-la*, the rate of rise is, therefore, as 1:6.9.

About 1 km. west of this pass, which is higher than the surface of the *Manasarovar*, the frontier of *India* is situated, and the road proceeds past *Namgya-rijing* and across the *Satlej* to *Poo*.

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DISTANCES, ALTITUDES  
AND PANORAMAS IN THE  
TRANSHIMALAYA



## CHAPTER XXVI.

### MY FIRST JOURNEY ACROSS THE TRANSHIMALAYA.

In Vol. III of this work I have given a description of my eight crossings of the *Transhimalayan System*, only one of which, in the Western part of the system, was approximately known from the exploration of one of the Pundits. This description, however, was written before the panoramas had been put together and arranged in chronological order. The panoramas have, therefore, not been discussed in connection with my description of the roads taken and the mountains explored. I have, therefore, and for the sake of completeness, to return to the eight crossings once more with the chief object of making as much use as possible of the sketches of landscapes.

Nor did I enter, in the first description, the distances between the several camps and the absolute altitudes of all of them. These figures as well as the rates of slopes are of great importance for the clear understanding of the morphology of the highlands. As reference has been made to them through all the preceding chapters of this volume, they should not be missing in those parts of my journey which fall within the boundaries of the *Transhimalaya* and which embrace the most important part of my last expedition. The following chapters, dealing with the *Transhimalaya*, will, therefore, have to be regarded as an addition to Chapters XXIX—XLIV of Vol. III, though, of course, the present part, which has nothing to do with rivers, roads, names and many other items, will be much shorter.

Finally the map to the scale of 1:1,000,000 constructed and drawn by Colonel H. Byström, has not been completed until lately. This map affords us an excellent general view of the whole *Transhimalayan System*, as Colonel Byström has combined and compared my original maps with the panoramas and did his best to follow the stretchings of the different mountain ranges. This is also one of the reasons why we have to return to the *Transhimalaya* once more. We should not forget that the central parts of the *Transhimalayan System* were a *terra incognita* before my journey. Only a few of the highest *Lunpo-gangri* Peaks had been seen from the south by members of Ryder's Expedition, and ranges belonging to the same system had been seen from the north by Nain Sing. The rest of our information

was derived from *China*, and was not entered on European maps of later years. It is, therefore, no wonder that I have made the best possible use of the material in information, maps and panoramas that I brought home from these regions.

We begin at *Camp CVIII* which we left at the end of Chapter XII. in this volume. It was situated on the S. E. shore of *Ngangtse-tso* at an altitude of 4,699 m. The surface of the lake was found to be at 4,694 m. On *January 18th, 1907*, our march goes 6 km. S. S. W. to *Camp CIX*, which is at an altitude of 5,189 m., or 495 m. above the lake, giving the very steep slope of 1:12.1. From a point up in the valley south of *Camp CVIII*, Panorama 123, Tab. 23, is taken, and from *Camp CIX*, Pan. 124, Tab. 23. The former shows us the beach-lines and desiccation terraces of the two lakes which nearly touch one another, the latter embraces most of the eastern lake, *Marchar-tso*, with the mountain range bordering it on its north and being the eastern continuation of the range just north of *Ngangtse-tso*.

On *January 19th*, we had 1 km. to the pass *Chapkar-la*, 5,326 m. high and 137 m. above *Camp CIX*; the rate of ascent is very steep, or as 1:7.3. From the pass to *Camp CX* or *Lamblung* at an altitude of 4,895 m., the distance was 9.8 km.; the descent is therefore 431 m., at a rate of 1:22.7. The direction is S. S. W.

The range which we crossed on these two marches seems to be a ramification from the *Ngangtse Range*. The latter stretches from east to west, and is situated to the south of three of Nain Sing's lakes, *Ngangtse-tso*, *Marchar-tso* and, perhaps, *Kyaring-tso*. It may be more correct to regard the range of *Chapkar-la* as an independent one, though the *Pongchen-la* indicates a connection between it and the *Ngangtse Range* proper, situated just south of it.

On *January 22nd*, a march of 5 km. took us to *Pongchen-la*, 5,371 m., being an ascent of 476 m. or as 1:10.5 in an easterly direction. From the pass to *Camp CXI*, 5,055 m., the distance was 6.7 km. S. E. and the descent 316 m., or as 1:21.2.

At *Camp CXI* we have crossed the mountain bridge of *Pongchen-la* joining the first little range with the *Ngangtse Range*, and entered the valley of *Buser-tsangpo* which is a northern or right tributary to the *Tagrak-tsangpo* belonging to the basin of *Ngangtse-tso*. We stick to the drainage area of the latter river all the way to *Sela-la*.

Panorama 119A and B, Tab. 21, is taken from *Pongchen-la*. It is interesting, for it shows from the dominating height of 5,371 m. a part of *Marchar-tso* to the N. 64° E. through the opening of the valley of *Titak*; to the S. E. it gives the impression of a comparatively open country, which is partly due to the valley of *Buser-tsangpo*. To the N. 89° W. the S. W. end of *Ngangtse-tso* is in sight.

Following the valley of *Buser-tsangpo* downwards, on *January 23rd*, from *Camp CXI* to *Camp CXII*, *Kapchor*, we covered a distance of 12.6 km. to the S. S. E. and descended to 4,959 m. or 96 m., being at a rate of 1:131.

The *Buser-tsangpo* has to be regarded as piercing the *Ngangtse Range* in a transverse valley which saves us from crossing this range in a pass.

From *Camp CXII*, Panorama 125<sup>A</sup> and B, Tab. 23, is sketched showing the mountainous region *Kapchor* to the S. W., Mount *Chara-tibo* to the N. W., the peak *Chao-tokde* to the E. N. E. and *Porchung* to the E. S. E.; to the S. E., south and S. S. W. there is a labyrinth of mountains, though most of them seem to be of a moderate elevation.

On *January 24th*, we had 17 km. to *Camp CXIII*, *Kayi-pangbuk*. The first half of this section is directed to the south, the latter half to the S. E. The differences of altitude are insignificant as we pass on undulating ground from the valley of *Buser-tsangpo* to that of the main river, *Tagrak-tsangpo*. *Camp CXII* was at 4,959 m., the *Tagrak-tsangpo*, at the point where we first reached it after 8 km., was 4,914 m., and *Camp CXIII* 4,930 m.<sup>1</sup> On the day's march the ground thus first falls and then rises again. *Camp CXIII*, however, is 29 m. lower than *Camp CXII*.

On *January 25th*, we covered 12.2 km. S. S. E. As *Camp CXIV*, *Nadsum*, is at 4,986 m., the rise from *Camp CXIII*, is 56 m., or as 1:218. The ground rises very gradually in the valley of the *Kesar-tsangpo*, which is a southern tributary to the *Tagrak-tsangpo*. The mountains to the east and west are to be regarded as primary or secondary ramifications from the main range *Pabla* which we are approaching on our road to the S. E.

Just a little bit east of *Camp CXIII*, I sketched from a low terrace a panorama, 131, Tab. 24, of the broad and open valley of the *Kesar-tsangpo* and *Naong-tsangpo*. To the E. N. E. is visible the valley by which the *Kung-tsangpo* comes down to join the main river, *Tagrak-tsangpo*. To the S. 70° E. is a mountainous region called *Tsaga*. S. S. E. is a region *Pupchen*.

Panorama 121<sup>A</sup>, B and C, Tab. 22, from *Camp CXIV*, *Nadsum*, situated higher up on the *Kesar-tsangpo*, embraces the whole of the horizon. To the N. 70° W. the mountains are called *Kokam*. To the N. W. the hills have a very moderate, rounded appearance; N. N. E., on the other side of the valley, is Mount *Yai*. N. 20° E. is the flat group known as *Tsaga*, mentioned above. To the N. E. a considerable valley called *Goa*, opens, indicating the grazing-grounds of the small *Gazella* antelopes. E. N. E. is a less conspicuous valley, *Yakchung*, a name indicating the existence of wild yaks in it. *Gumcho* is a cupola-shaped mountain to the E. S. E. To the S. 56° E. the *Naong-sung* valley opens out to the plain; in this valley our road continues to the S. E. S. 35° E. is a more considerable mountain peak with snow, called *Pupchen*. S. S. E. the *Rekur* valley comes out, and to the right of it is a

<sup>1</sup> The figure of 4,910 m. on the map, Pl. 7, is wrong, as mentioned in the meteorological diary, Vol. VI, pl. 34, note.

region called *Lassar*. Nearly south is a valley called *Tokya*, and S. S. W. is *Toke-ri*. S. W. of the camp is a large valley, *Martsu*, by which the upper *Kesar-tsangpo* seems to come down. North of the latter is another valley, without a name, and obviously carrying the upper course of the little brook flowing just west of *Kesar-tsangpo*.

On *January 26th*, we travelled 15.8 km. E. S. E. At *Camp CXV* in the valley of *Naong-sung* the altitude was 5,134 m., being 148 m. above *Camp CXIV*; the rise is thus as 1:106.7. In spite of our approaching such an important range as the *Pabla* the ascent of the ground, from the northern side, is very gradual, proving that the destructive and accumulating powers have accomplished during bygone ages a very energetic work in the *Transhimalaya*, which on the south borders the *Chang-tang* or the great plateau-land without an outlet to the sea.

Panorama 129, Tab. 24, does not reach very far around, as *Camp CXV*, from where it was taken, is situated in a valley. However, some of the mountains we had passed on the previous day were now visible to the N. W.

On *January 27th*, we travelled 14 km. S. E. to *Camp CXVI* in the valley of the *Pupchung* brook which is at the height of 5,344 m. or 210 m. above the preceding camp. The rise is at a rate of 1:66.6 showing a somewhat accelerated ascent as compared with the preceding section. Just before reaching the camp we had to cross a little distinctly secondary threshold in a spur of the *Pabla* Range, at a height of 5,399 m., or only 55 m. above the camp.

From this threshold Panorama 127, Tab. 23, is drawn. This view is of considerable importance as it gives an idea of one of the water-parting ranges of the *Transhimalaya*, a watershed of the highest orographical and hydrographical dignity, *viz.* between the interior, self-contained regions of *Central Asia*, and the *Indian Ocean*. The panorama discloses the crest and the peaks of the *Pabla* Range from N. 25° E. to the east, south and S. 62° W., where the *Pupche* raises its snow-covered head. The observation point being at the considerable altitude of 5,399 m. the range makes no imposing impression, and as far as can be seen from here, it has no very high peaks, probably hardly any above 6,500 or 6,700 m. The panorama shows very clearly the saddle of *Sela-la* between E. and S. 73° E. From S. E. to S. W. there are several peaks covered with some snow. To the south is *Pupchung-ri*, not entered on the panorama, but appearing on the map, Pl. 7, from which the brook of *Camp CXVI* comes down.

On *January 28th*, we had 16 km. E. S. E. to the great water-parting pass of *Sela-la*, which has an altitude of 5,506 m. or 162 m. above *Camp CXVI*, being a rate of ascent as 1:99. The rise is therefore very gradual. From the pass we had 2.9 km. S. E. to *Camp CXVII* which was at an altitude of 5,225 m. or 281 m. below the pass. The descent on the southern side is thus very steep, or as 1:10.3.

Panorama 133, Tab. 24, is taken from a secondary threshold situated some three kilometers W. N. W. of the pass and at a height of 5,434 m. It unrolls to the S. W. and W. S. W. mountains belonging to the *Pabla* Range, and to the south hills belonging to the next range, the one of *Shib-la*. To the S. S. W., in the foreground, we have the deep-cut valley of the *Sangra-pale*, which joins the *Sela* valley, also visible on the sketch, nearly due south.

On *January 29th*, we travelled 15.8 km. S. S. E. in the valley of the *Sele-nang* which is a northern or right tributary to the river of the *Sela* valley. The latter is no doubt in its lower course identical with the *Ke-tsangpo*, a tributary to the *Mü-chu*, a northern tributary to the great *Tsangpo*. *Camp CXVIII* is situated at *Selin-do*, near the first confluence, and at an altitude of 4,832 m. On this section the *Sele-nang* valley thus descends 393 m. or as 1:40.2 showing more accentuated gradients on the southern side of the range, *i. e.* as soon as we reach the peripheric regions with an outflow to the ocean.

The orographical construction round *Camp CXVIII* in the valley *Selin-do* appears from Panorama 130, Tab. 24, where considerable erosion terraces remain as monuments of an epoch with heavy precipitation. To the S. E. is the entrance to the valley of *Porung* by which we continued south-eastwards to the crest of the next range, that of *Shib-la*. S. 11° E. is a mountain group we left to our right. To the S. W. is the *Sela* valley going down to the junction with the *Mü-chu* River, which I followed on my second crossing.

Too little is known of the orography of the *Central Transhimalaya* for allowing us to draw any conclusions as to the stretching of the great continental water-parting especially to the east of *Sela-la*. I have been able only to follow its principal points on my maps. Thus, for instance, I have the impression that the *Chang-la-Pod-la* is situated in another range than the *Sela-la*, *viz.* the one which we crossed in the pass *Shib-la*, and it is well known from many other regions that water-partings often run over from one range to another. Further I believe that the *Pabla* Range west of the *Sela* Pass runs to the W. N. W., N. W. and north, forming a secondary watershed between the two rivers of *Targo-tsangpo* and *Tagrak-tsangpo* and between *Dangra-yum-tso* and *Ngangtse-tso*. Such problems cannot be solved in detail by the first pioneer whose view does not reach very far from the sides of his own route. Here is work in the future for many generations of explorers.

The next pass on our way to the S. E. was crossed on *January 30th*. *Shib-la* had an altitude of 5,349 m. or 517 m. above the preceding camp, being a rate of ascent of 1:38.7, as the distance amounted to 20 km. *Camp CXIX* at *Tagar-ogma* was at a height of 4,998 m. or 351 m. below the pass. The distance from the *Shib-la* to the camp being 3.8 km. S. W. the rate is 1:10.8. Here again the slope on the southern side is much steeper than on the northern.

*Camp CXIX* is situated in the valley of the *Muva-chechen*, which is either a southern or left tributary to the *Sela* valley or *Ke-tsangpo* mentioned above, or pierces its course directly to the *Mü-chu*. If my conjecture is correct, viz. that the *Shib-la* and *Chang-la-Pod-la* belong to one and the same range, the latter hydrographical arrangement seems to be the more probable.

Panorama 128A and B, Tab. 23, is, again, instructive, as it gives the spectator a clear idea of the mountains visible from *Shib-la*, and their morphological features. To the N.  $11^{\circ}$  W. we behold the valley of *Porung*, by which we had just ascended to *Shib-la*. To the N. N. E. we see in a far perspective the E. N. E. continuation of the *Pabla* Range. It is impossible to tell where it goes to. I only have a suspicion that it stretches to the E. N. E. or even between E. N. E. and N. E. and thus is parallel to the *Nien-chen-tang-la*. To the N.  $60^{\circ}$  E. we have the very flat protuberance of the crest of the *Shib-la* Range itself. The most interesting is here to notice that we, standing on the pass, have a nearly quite free view to the N.  $60^{\circ}$  E. Usually, a pass is a saddle without any distant view in the direction of the crest. The crest of the *Shib-la* Range is, therefore, very even, and on the pass one has the impression of being nearly at the highest point. The same is the case in the other direction as may easily be seen on the panorama. To the S. E. a range, *Luba*, is visible which certainly is the eastern continuation of the range of *Chesang-la*. S.  $16^{\circ}$  W. we see the valley by which we have to ascend to *Chesang-la*. S.  $85^{\circ}$  W. is the valley of *Muva-chechen* directed to the west, and at the brook of which our *Camp CXIX* is pitched.

From the camp just mentioned Panorama 132A and B, Tab. 24, was drawn embracing nearly all the surrounding mountains. Between the mountains to the west the valley of the *Muva-chechen* goes down. A little sketch, Pan. 134, Tab. 24, is a view to the S. W. and west up the valley of the little tributary *Dangsar*, showing that the valleys in these regions, and in spite of the outlet to the sea, are not at all deep-cut, but rather flat and open.

Our course on *February 2nd* is due south crossing a new range in the pass *Chesang-la*. This range is either a ramification from one of the neighbouring ranges or a more independent range parallel with the two we had crossed in *Sela-la* and *Shib-la*. West of *Chesang-la* it is pierced by the *Mü-chu* just below or south of its sharp bend from an eastern to a southern direction.

From *Camp CXIX* to *Chesang-la* the distance is 10.6 km. south. The pass has an altitude of 5,474 m. or 476 m. above *Camp CXIX*, being a rise of 1:22.3. *Camp CXX* at *Tak-rerar* is at an altitude of 4,635 m. or 839 m. below *Chesang-la*. The distance here being 10.1 km., the rate of descent is as 1:12, nearly twice as steep as on the northern side. Here again the northern slope is more gradual than the southern.



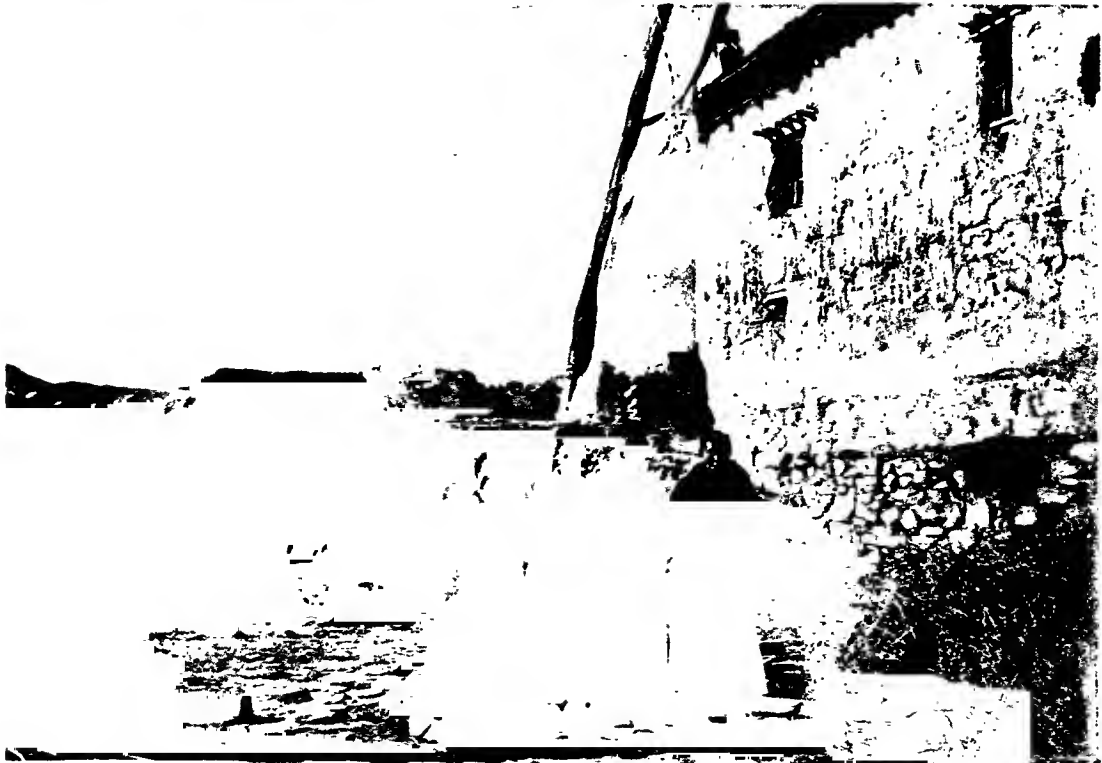


MY GARDEN IN SHIGATSE.





BOATS WITH PILGRIMS ON THE TSANGPO ON THEIR WAY TO TASHI-LUNPO.



NUNS OF GANDAN-CHÖDING-GOMPA.





THE HOUSE OF TASHI LAMA IN TANAK (STA-NAKPO) ON THE  
NORTHERN OR LEFT BANK OF THE TSANGPO.



From *Chesang-la* the view to the south is open only between S.  $24^{\circ}$  E. and S.  $86^{\circ}$  W., as shown on Pan. 136, Tab. 24. The mountain range visible in this direction is the one with the pass *Dangbo-la* or *Dangbä-la*, the next we had to cross. Pan. 137A and B, Tab. 25, is taken from *Camp CXX*. To the N. W. it gives the contour lines of the mountains *Singe-kanyak*, *Tseri-rakpa* and *Kunge* and between them the valley *Kunglung*. To the N. N. W. it shows the range of *Chesang-la* and to the N. N. E. the mountainous region of *Tulung-mukpo*. To the N.  $85^{\circ}$  E. it has the peak *Chamdung*, to the S. S. E. the road down to *Bup-chu* which we had to follow the next day, east of the mountain group *Teri*.

If the march between the two last camps formed a convex line crossing a pass, the march of February 2nd forms a concave line crossing a river, the *Bup-chu*. It has, therefore, to be divided into two sections, the first from *Camp CXX* to the river descending to an altitude of 4,467 m., or 168 m. lower; the distance is 6 km., the rate of slope as 1:35.7 and the direction S. S. E. The ascent south of the river in the valley of *Dangbo-chu* or *Dangbä-chu* is 152 m. to *Camp CXXI*, *Tamring*, which is at an altitude of 4,619 m., the distance being 7.7 km. S. E. and the rate as 1:50.7, showing that the slope falling to the north is, as usual, less steep than the one falling to the south. The river *Bup-chu* flows westwards in a narrow latitudinal valley between two parallel ranges, and joins the *Mü-chu* opposite *Linga-gompa*.

From the point where our road crosses the *Bup-chu*, Pan. 139, Tab. 25, is taken. To the N.  $15^{\circ}$  W. it shows the valley by which we have come down from *Chesang-la*, to the N.  $70^{\circ}$  E. the valley by which the *Bup-chu* comes down and which, for a more or less considerable distance serves as a hydrographical boundary between two parallel ranges of the *Transhimalaya*, viz., the one of *Chesang-la* and the one of *Dangbo-la*. To the W. S. W. the *Bup-chu* valley continues down to the *Mü-chu*.

The next day's march, on *February 3rd*, again forms a convex line crossing a new pass, *Dangbä-la*. Here an irregularity enters in the morphological law prevailing hitherto, viz., that the northern slope is more steep than the southern. From *Camp CXXI* we have 11.4 km. S. S. E. to the pass which is at an altitude of 5,250 m., being a rise of 631 m. or as 1:18, whilst the descent on the southern side is 13 km. S. E. to *Camp CXXII*, *Ngartang*, 4,909 m. high, or 341 m. below the pass, the slope being here as 1:38. The slope to the north from *Dangbä-la* is, therefore, more than twice as steep as the slope to the south.

Panorama 135, Tab. 24, gives a view to the S. E. from the pass, showing the range of *Ta-la*, the one we had to cross the next day. Pan. 138, Tab. 25, is a nearer view of a part of the same range.

The range we crossed in *Dangbä-la* is probably the western continuation of the famous *Nien-chen-tang-la*, which, like the preceding ranges, farther west is pierced

by the meridional valley of the *Mü-chu*. The mountainous country to the E. N. E. of the *Dangbä-la* is, however, too little known — *i. e.* not known at all — to permit us, with any degree of certainty, to regard the *Dangbä-la* Range as the immediate continuation of the high range on the southern shore of the *Nam-tso*. With our present state of knowledge this seems anyhow to be the case.

On *February 4th*, we crossed a new pass, *Ta-la*, 5,436 m. high, being at 527 m. above *Camp CXXII*, from where the distance is 10 km. in an E. S. E. direction and the slope as 1:18.9. From the pass we had 11.8 km. S. E. to *Camp CXXIII, Hor*, where the altitude was 4,523 m. or 913 m. below the pass, the rate of descent being as 1:12.9. Here again the southern slope is very steep. It is difficult to determine the orographical dignity of the range of *Ta-la*. Either it is a ramification from the *Nien-chen-tang-la*, or it is a special range situated south of it.

Panorama 140, Tab. 25, is taken from a point not far below *Ta-la*, and S. E. of the pass. In my personal narrative<sup>1</sup> is a reproduction of a panoramic sketch drawn from the pass itself where the nearest protuberances of the crest on both sides of the saddle only permit a view between S. 41° E. and S. 18° E. Some of the near and distant peaks are easy to identify as appearing on the two panoramas. The view from *Ta-la* unrolls three or four different ranges in front of us, or rather ramifications from one and the same range. To the S. S. E. we behold some of the distant, snow-covered peaks belonging to the northern-most range of the *Himalaya*. In front or north of them is the mighty valley of the *Tsangpo* or Upper *Brahmaputra*.

Pan. 142A and B, Tab. 25, gives us a view of the landscape around *Camp CXXIII, Hor*, with the mountain regions of *Peeri* to the S. W., *Ayang* to the W. S. W., the *Gula* valley to the west, the road to *Ta-la* to the N. N. W., the *Yamdo* valley to the N. N. E. and the *Kori-yuri* Mountain to the N. E.

On *February 5th*, our road goes 7.2 km. south in the *Pema* valley to *Camp CXXIV, Shepa-kava*, where the altitude is 4,344 m. or 179 m. below *Camp CXXIII*. The rate of descent is here as 1:40.2.

The march of *February 6th* shows the morphological law in a more pronounced way than before. We had 7 km. S. S. E. to the pass *La-rok* at an altitude of 4,440 m., only 96 m. higher than *Camp CXXIV*, the rate being as 1:73. From the pass to *Camp CXXV*, 3,949 m. high, the distance is 8.6 km. S. E., or a descent of 491 m. at a rate of 1:17.5. *La-rok* certainly is situated in a quite secondary range, being a ramification from the nearest principal range to the north.

Pan. 145, Tab. 26, is a view from *La-rok* to the east, S. E. and S. S. E. The most interesting feature on it is that a group of rather accentuated peaks are situated

<sup>1</sup> *Transhimalaya*, Vol. I, Swedish Edition, p. 384, and German Edition, p. 377.





LAMAS OF MENDONG-GOMPA.



LAMAS OF TASHI-LUNPO.





LADIES IN SHIGATSE



CHILDREN IN SHIGATSE.





SOME OF THE MEMBERS IN THE SHOOTING COMPETITION AT THE NEW YEAR FESTIVAL IN SHIGATSE



SOME CHINESE AND TIBETANS AT CHAGA CAMP 135. TO THE LEFT THE  
LEFT OR NORTHERN BANK OF THE TSANGPO.



in the region called *Tanak* (*Sta-nakpo*). Some 2 km. S. E. of and below the same pass, Pan. 144, Tab. 26, was drawn. It gives an idea of the main valley below our feet and the great tributary valley coming in from the south. The peaks S. 72° E. and S. 57° E. are easily recognizable also on Pan. 145. They give the impression that the mountains just north of the *Tsangpo* are higher here than farther north.

On *February 7th*, we had 10.7 km. to the River *Tsangpo*. Panorama 146A and B, Tab. 26, taken from *Camp CXXV*, *Ye*, gives an idea of the mountainous landscape surrounding the plain of *Ye*.

If we add all the distances mentioned in this chapter along our road from *Ngangtse-tso*, *Camp CVIII* to the point where we first reached the *Tsangpo*, we get a road of 272.7 km. in length. In Vol. III, p. 247 I have given this distance as being 260 km. only. The discrepancy is due to the fact that the latter measurement was taken from the construction map, whereas the 272.7 km. were measured on the map forced into the net of co-ordinates. Under such conditions the difference in length is very insignificant.

*Camps CXXV* and *CXXXIII* being both at *Ye* it may seem puzzling that the former has got an altitude of 3,949 m., the latter one of 4,002 m. The two camps were, however, situated at different places in the valley of *Ye*. This is the reason why I have not advised Prof. Ekholm to take an average value for both. On the other hand, the altitude of 3,930 m. for the point where we first reached the *Tsangpo*, is certainly too low, and has to be changed in accordance with the observations made along the river later on. However, the altitudes along the river cannot always be compared with one another, as some places, which on the map seem to be situated on the river itself, in reality are situated on terraces which may have a considerable height above the river bed.

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## CHAPTER XXVII.

### THE SECOND CROSSING OF THE TRANSHIMALAYA.

Before proceeding to the hypsometrical relations and the panoramas along my second crossing of the *Transhimalayan System*, a few words should be said regarding our road along the *Tsangpo*, and the panoramas pertaining to this part of my journey.<sup>1</sup>

From the village *Chang-tang* where I crossed the *Tsangpo* a few kilometers N. W. of *Shigatse*, to the confluence of the *Dok-chu* with the *Tsangpo*, a little above *Chaga* or *Camp CXXXV*, the distance along the road on the northern bank will be 93 km. — if I calculate a short-cut from *Camp CXXXII* to *Camp CXXXIV*, instead of going up to *Camp CXXXIII* at *Ye*.<sup>2</sup>

The absolute altitudes obtained from a boiling point thermometer and three aneroids are, as I have said before, too much dependent on the atmospheric pressure to be quite reliable. Along a river with a very slow fall one becomes, of course, very sensitive regarding the altitudes given by the instruments. However, I think that 3,850 m. will be fairly near the real altitude of the *Tsangpo* at *Chang-tang*, and 4,013 m. at the confluence of the *Dok-chu* and *Tsangpo*.<sup>3</sup> For the distance of 93 km. the fall of the river would, therefore, be 163 m., and the rate of fall as 1:571. Though this fall is very gradual it is steeper than we have found in the Upper *Indus*.

The panoramas along this section of my road are meant to give an impression of the mountainous landscapes of the *Tsangpo* valley. Panorama 143, Tab. 25, is taken from *Camp CXXVI*, the village of *Rungma*, and embraces only the hills to the south and S. W., — those to the north being too near.

Panorama 147A and B, Tab. 26, drawn from the village of *Tana* (*Sta-nakpo*) is more instructive as it embraces the whole valley, except a less important part

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<sup>1</sup> *Cp.* Vol. II, p. 293 *et seq.*

<sup>2</sup> From *Tana* to *Chang-tang* I travelled with boat on the river, though the red line on its southernmost branch has been omitted on Pl. 8.

<sup>3</sup> If compared with the altitude of *Chaga* this figure is obviously too low, as *Chaga*, with 4,032 m., is only a few meters above the river.





THE VILLAGE OF RINGWA



hidden by the village. To the N.  $88^{\circ}$  E. we see the opening of the gigantic valley, the direction in which the Upper *Brahmaputra* continues its way to the east, between the *Transhimalaya* and the *Himalaya*. To the N.  $12^{\circ}$  E. is a top, *Meshung-chang-ri*, situated quite near the village. To the N. E. is Mount *Sasang* and the valley *Yang-yu*. To the S. E. are the mountain regions *Gyangtse-pu* and *Chohuk*, and to the south the ridge *Seduru*. The sketch shows in its middle a slight indication of the great winding river, and, in the foreground, the erosion terrace, and, on the top of it, one of the houses of Tana.

From *Shigatse* two panoramas were taken, one, Pan 150A, B and C, Tab. 27, from a point just west of the little town, the other from the foot of *Shigatse-dsong*. The first shows a ring of mountains, the nearest of which are those to the N.  $75^{\circ}$  E. and west. To the S. S. E. there is an interruption, not visible on the panorama, for the *Gyangtse* River and the road to *Gyangtse*. To the S.  $37^{\circ}$  W. the country is comparatively open, and here the road goes to the famous monastery of *Sakya*. S.  $70^{\circ}$  W. the great monastery of *Tashi-lunpo* is visible at the southern base of the range situated west of *Shigatse*. To the N.  $60^{\circ}$  and  $50^{\circ}$  W. *Shigatse-dsong* is seen on its isolated hill. To the N. N. W., north and N. N. E. I have slightly indicated the houses of the town, between which and the hills in the background the *Gyangtse* River flows down to the *Tsangpo*. Pan. 152, Tab. 27, represents only a part of the same view as seen from the base of the *dsong* hill. The nearest mount, to the N.  $87^{\circ}$  E. is the same as the one to the N.  $75^{\circ}$  E. on Pan. 150, and by a comparison between the two all the details may easily be checked.

Pan. 151A and B, Tab. 27, is a view from *Camp CXXIX, Sadung*. In the background of some houses of the village it shows the last ramifications from the *Transhimalayan* hills to the N. W., and to the N. N. W. the opening of the valley of *Dongka-pu*. Eastwards is the great valley of the *Tsangpo*, which here seems gradually to become more and more narrow towards the east. To the S. E. opens the valley of the *Gyangtse* River with the road to *Shigatse*.

Pan. 149, Tab. 27, is only a small sketch drawn from *Camp CXXXII, Kuru*, just below the plain of *Ye*. It represents the *Tsangpo* valley from the S.  $70^{\circ}$  E. to the south, where a tributary valley comes out.

Pan. 154A and B, Tab. 28, taken from *Camp CXXXIV, Pusum*, on April 3rd, 1907, embraces three quarters of the horizon. The N. W. quadrant is missing for here a hill in our immediate vicinity hides the view. The panorama is interesting as it shows the *Tsangpo* valley both to the east and west, and also how narrow it is in the region of *Pusum* if compared with the broad, open plain south of *Ye*. To the north the *Ngolung* valley comes down. To the E. N. E. is the little village *Pusum*. To the E. S. E. the winding course of the great river is seen between the *Transhimalayan* and *Himalayan* Mountains. To the south is the *Ponda* valley,

and to the W. S. W. again the *Tsangpo* valley, in this direction still more narrow than to the east. Remembering that *Pusum* has an altitude of 4,062 m. whilst *Chaga*, higher up the river, has only 4,032 m., a look of the Pan. 154<sup>A</sup> will explain this seeming discrepancy. It shows that *Pusum* is situated on a rather high terrace on the left bank of the river.

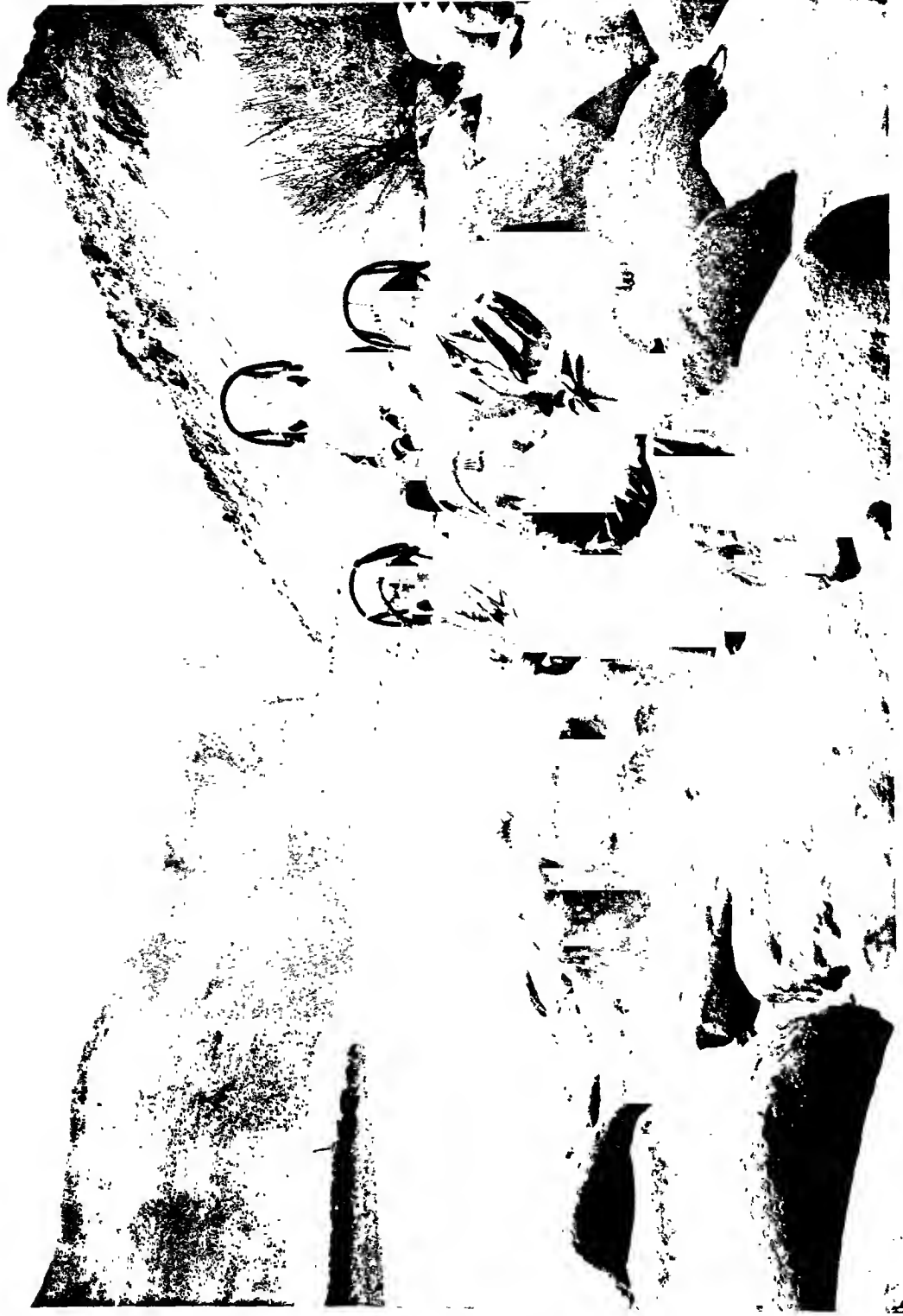
Pan. 148, Tab. 26, is drawn from a point less than 1 km. N. W. from *Chaga*. Here we behold the valley of the *Tsangpo* to the south, to the S. 67° W. Mount *Dombi-tang*, to the S. 81° W. the more distant *Karong*; between the latter two the *Damchu-kamba* or *Tsangpo* comes out from the W. S. W. To the W. N. W. is the tributary valley of the *Dok-chu* with our road to the second crossing of the *Transhimalaya* and with the Mount *Dambo-richen* in the background.

Pan. 153, Tab. 28, is a little view from *Camp CXXXV*, *Chaga*, showing to the N. W. the valley of *Yangyö* and in the background, Mount *Gesu*. Pan. 155<sup>A</sup> and B, Tab. 28, represents, to the south, the monastery of *Pinsoling*, and to the S. 28° W. the peak *Ngombi-chong*. To the W. N. W. is again the *Dok-chu* valley and to the N. W. the *Yangyö* valley; a part of Mount *Gesu* stands between the two. Pan. 155<sup>A</sup> should be compared with the fourth photograph opposite p. 304 of Vol. II for getting an idea in how far it is correctly drawn.

Finally Pan. 159, Tab. 29, is taken from the confluence of the *Tsangpo* and the *Dok-chu*. To the S. 49° W. the *Tsangpo* valley is visible. In the foreground to the left is the surface of the river. The *Dok-chu* itself is not visible, as I was standing on the low gravelly cape between the two rivers.

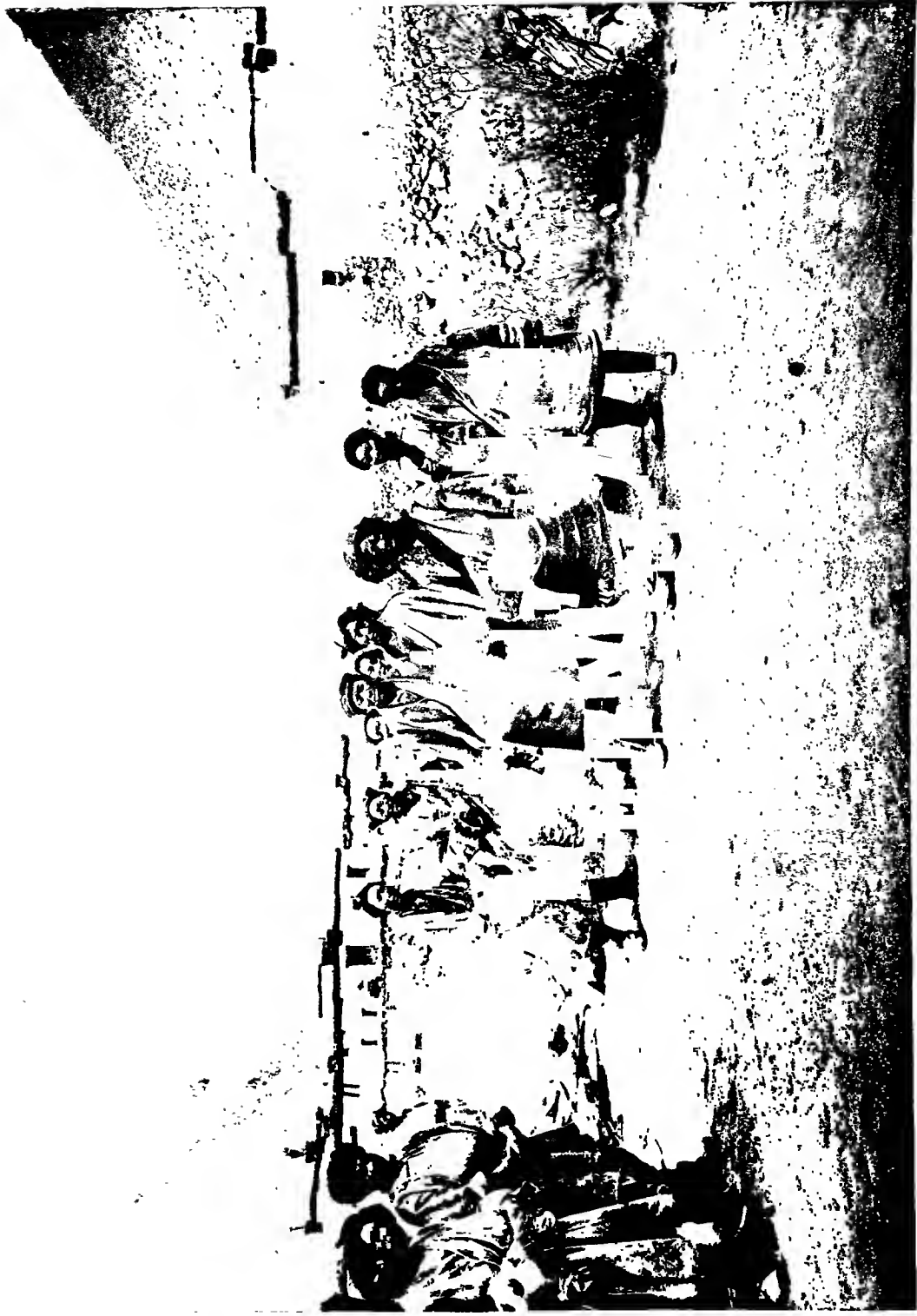
The second crossing of the *Transhimalaya* was regarded as beginning from the confluence of the *Tsangpo* and the *Dok-chu* (Vol. III, p. 266 *et seq.*). The absolute altitude of this point was considered to be 4,013 m. On *April 5th*, we marched 12.7 km. W. N. W. to *Camp CXXXVI*, *Tangna*, at an altitude of 4,038 m., being a rise in the valley of the *Dok-chu* of 25 m., or as 1:508, which is a little steeper than the fall we calculated from the same confluence to *Chang-tang* near *Shigatse*, where we found 1:571. From *Tangna* Pan. 158, Tab. 29, was drawn, showing to the S. 65° E., the valley of the *Dok-chu* going down to the confluence.

On *April 7th*, our march goes 14.9 km. westwards, rising 32 m., or to 4,070 m. which is the altitude of *Camp CXXXVII* at *Lingö*, a very short distance below the confluence of the *Mü-chu* with the *Dok-chu*. The rate of ascent is here 1:466. The sketch I drew from this place, Pan. 161<sup>A</sup> and B, Tab. 29, will give the reader a very good idea of the appearance of the mountains around the confluence of the two rivers. To the N. 74° E. we have the valley of the *Dok-chu* going down to the confluence with the *Tsangpo*. S. 20° W. is the little valley of *Doglo*, S. W. is Mount *Deru*, to the west is the *Dok-chu* valley and round the corner in the foreground, W. N. W., the road turns up the valley of *Mü-chu*.



LOOKING WEST ALONG THE TSANGPO FROM CHAGA, CAMP 135.





A GROUP OF TIBETANS IN THE VALLEY OF TONG.



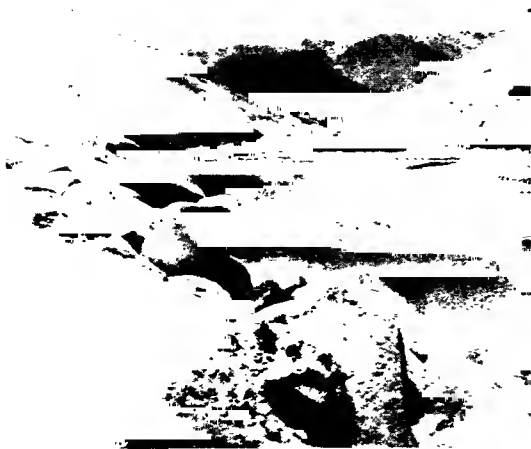




THE GOVERNOR OF SAKA-DSONG.



TIBETANS FROM THE DISTRICT EAST OF TERI-NAM-TSO.



THE MU-CHU, LOOKING DOWN TO THE CON-  
FLUENCE WITH THE DOR-CHU, FROM A POINT  
JUST ABOVE LINGO.

THE MU-CHU VALLEY JUST ABOVE LINGO





IN THE MU-CHU VALLEY.



AT THE VILLAGE MACHUNG IN THE DOK-CHU VALLEY.



THE BRIDGE OF THE LENJO RIVER.



A MAN-RIGMO AT LENJO.



On *April 8th*, our road takes us up the valley of *Mü-chu* 14.3 km. N. N. W. to the village and monastery of *Tong*, *Camp CXXXVIII*, where the altitude is 4,167 m. The latter figure is rather misleading as the camp was situated at a considerable height above the bed of the river. However, the rise from *Camp CXXXVII* amounts to 97 m., and the rate is 1:147. The panorama, 160A and B, Tab. 29, from *Tong*, is again instructive, and gives the impression of narrow, deep-cut valleys. To the S. 16° E. the view opens through the valley of *Tong* with the river *Mü-chu* by which we have arrived. In the distance a part of Mount *Kabu-kidang* is visible. This part of the panorama should be compared with the third photograph opposite p. 270 in Vol. III, which gives an idea of the degree of correctness at which I have been able to arrive, and which has been scientifically examined by Professor Karl D. P. Rosén.<sup>1</sup> To the S. W. and west is the bulky mountain mass of *Takbo-che*, and N. 62° W. the group *Ya-munya* to the left of which the little tributary valley of *Tina* comes out, and to the right of which the *Mü-chu* valley continues to the north to the water-parting of the *Transhimalaya*. To the N. N. W. and N. N. E. is the monastery of *Tong* with its several buildings, and to the N. 80° E. the tributary valley of *Tong-puchen*. On its southern side a part of the ridge *Tovakü* is also visible with one of the characteristic houses at its base.

On *April 10th*, we travelled 9 km. north to *Camp CXXXIX*, *Ge*, or *Ghe*, which is the name of a tributary valley entering here from the east. The altitude at *Ge* is 4,204 m. which is also misleading as the camp, again, is situated at a considerable height above the bed of the *Mü-chu*.<sup>2</sup> The difference in height, from *Tong*, is 37 m. and the rate of ascent, along the road as 1:243.

On *April 11th* we had 16 km nearly north to *Camp CXL* or *Sirchung*, where the altitude is only 4,177 m. or 27 m. lower than *Camp CXXXIX*, meaning a slope of 1:593. This is due to the fact that the latter camp is situated on a terrace at a considerable height above the main river, whereas the camp of *Sirchung* is in the bottom of the valley. As a matter of fact the fall of the *Mü-chu* is somewhat steeper on this section of its course, as could be seen from the more common rapids.

From *Sirchung* Pan. 156A and B, Tab. 28, was drawn. From the east the *Gelung* valley enters, and to the S. 55° E. on the eastern side of the river, *Gompa-song* is visible. Below and in front of the peaks S. 31° E. and S. 12° E. the *Mü-chu* valley is seen by which we have ascended. To the N. 24° W., just to the right of a few houses of the village *Sirchung*, the valley of the *Mü-chu* continues in the direction of the great Transhimalayan water-parting. Nearly due north is the monastery of *Lelung-gompa*, which I have described elsewhere.

<sup>1</sup> Cp. Ymer 1918, p. 125 *et seq.*

<sup>2</sup> Cp. photo p. 272, Vol. III.

The next march, on *April 12th*, continues in a nearly north-westerly direction for 12.6 km. to *Camp CXXI* or *Kating*, where the altitude amounts to 4,229 m., 52 m. above *Sirchung*, and a rate of 1:242, showing still a very slow fall of the *Mü-chu* valley. In Vol. III, p. 272 there is a photograph of my camp at *Kating*, and Pan. 157, Tab. 28, shows the *Mü-chu* valley continuing N. N. E.

On *April 13th*, we travelled 16 km. N. N. E. and north to *Camp CXLII* or *Linga-gompa*, at an altitude of 4,302 m., or a rise of 73 m. *Kating* and *Linga* both being situated along the river, may be compared directly, the rate is here 1:219 which is still a very gradual fall.

Between p. 272 and p. 273, Vol. III, there are some sketches from *Linga* and other places in the neighbourhood. Between p. 274 and p. 275 there are three photographs of *Linga-gompa*. Pan. 163, Tab. 30, is a view of the bridge across the right, or western, tributary *Lenjo*, with the *Mü-chu* valley to the right. Pan. 167, Tab. 30, is taken from *Linga-gompa* and gives a view up the valley of *Bup-chu*, the upper course of which we had passed on the first crossing. In the background due east is the peak *Luchen*, and along the *Bup-chu* we see the villages of *Damochar*, *Dela* and *Linga-gyu*; between the two rivers is the village of *Linga*, and in the foreground *Mü-chu*. *Pongra*, *Tabu* and *Donglung* are mountain regions along the eastern side of the valley, and *Kipuk* is a little tributary from the same side.

On *April 17th*, our road takes us 9.6 km. to *Camp CXLIII*, *Langmar* where the altitude is 4,331 m., or 29 m. above *Camp CXLII*, the rate being, only 1:331. The direction is N. N. W. Pan. 165, Tab. 30, shows, to the N. 45° W., how very narrow the valley is in this section, and how steep the *Donglung* tributary is, coming down from the N. 52° E. Pan. 164, Tab. 30, is taken from *Langmar* in the direction of our road to the N. W.

On *April 18th*, we travelled 12 km., N. W. and W. N. W. to *Camp CXLVI*, *Govo*. Here the altitude is 4,524 m., 193 m. above *Camp CXLIII*, and the rate of ascent as 1:62. The gradient is, therefore, much steeper than hitherto. If we consider only the 8 km. from *Camp CXLIII* to the junction of the *Ke-tsangpo* and *Pashu-tsangpo*, the latter being the upper course of the *Mü-chu*, the rate becomes still steeper or as 1:44, for at the confluence the altitude is 4,513 m.

Pan. 162A, Tab. 30, shows the view up the *Pashu* valley to the west, giving an idea of its narrowness. Pan. 162B shows the confluence of the two rivers as seen from the same point as Pan. 162A. The *Ke-tsangpo*, as I have said before, is no doubt the lower part of the *Sela* valley. The brooks flowing down to the south from *Sela-la* to *Chang-la-Pod-la* thus join at this point, and go to the *Mü-chu*. Just below the confluence, and particularly on the section of steep fall, 1:44, the *Mü-chu* breaks through the range of *Chesang-la*, mentioned above. The hills to the west and east of the lowest part of *Ke-tsangpo* are called *Namnam* and



INHABITANTS OF THE VILLAGE OF GOVO. TRANSHIMALAYA



THE BROAD, OPEN VALLEY OF AMCHOK-YUNG. TRANSHIMALAYA. IN THE FOREGROUND MANI-STONES.





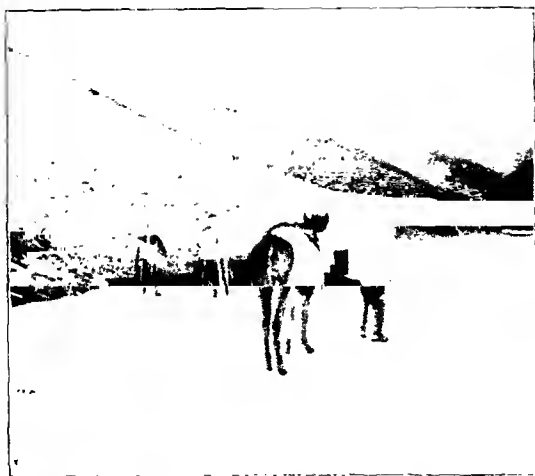


THE TAROO-GANGRI FROM A POINT BETWEEN TABLUNG-FA AND CAMP 156.



THE TAROO-GANGRI FROM CAMP 151. (OF PANGAMA 150. B)





ÜCHÜ AND THE VALLEY TO CHANG-TA-POD-TA.





UPPER PART OF THE ICE COVERED VALLEY LEADING TO CHANG-LA-POD-LA.



TWO OF OUR YAKS.



*Amiri-rung* or *Ami-ri-rung*. On P. 275 and 276, Vol. III, there are some photographs and sketches from this region.

On *April 20th*, the distance to *Camp CXLV*, *Chomo-sumdo*, is 19.2 km. due west. The rise is 271 m. or 4,795 m. at *Camp CXLV*. The rate is 1:71. The *Pashu-tsangpo*, streaming from west to east, is no doubt situated in the tectonic valley which separates the two ranges of *Chesang-la* and *Shib-la* from one another.

On *April 21st*, we crossed the great continental water-parting in the pass *Chang-la-Pod-la*, or »The Pass between Northern and Southern Tibet.« Its altitude is 5,572 m. The ascent from *Camp CXLV* is, therefore, 777 m. The distance being 9.2 km. W. N. W., the rate is 1:11.8. On the northern side we had 6 km. W. N. W. to *Camp CXLVI*, *Cha-oktsang*, where the altitude is 5,233 m. or 339 m. below the pass, the rate thus being 1:17.7. On both sides the water-parting crest is thus very steep, and, as usual, steeper on the southern than on the northern side of the range.

Some photos were taken from the pass itself. They are to be found in Vol. III between p. 276 and 277, and should be compared with Pan. 166, Tab. 30. The latter is interesting as it shows the whole horizon as seen from *Chang-la-Pod-la*. The view, however, is not at all far-reaching, and nearly the whole panorama represents hills in our immediate vicinity and belonging to the water-parting crest itself. Only to the N. 60° E. there is a distant range, probably the western continuation of the one of *Shib-la*. To the S. 55° E. and in the direction of *Korso* is the road by which we climbed up to the pass. To the N. 35° W., in the direction of the *Mug-balung* valley, our road goes down from the pass, soon turning to the left around the rocky corner and continuing westwards. Pan. 169, Tab. 31, is taken from *Cha-oktsang* and gives a view of the very near mountains.

Having crossed the pass we are on the *Chang-tang* or Northern Plain. Still the descent is comparatively steep, much steeper than in the lower *Mü-chu* valley. We had 14.7 km. W. N. W. to *Camp CXLVII*, *Kyam-dam*, on *April 22nd*, and descended 183 m., or to 5,050 m., being a rate of 1:80.

The Panorama 171, Tab. 31, taken from *Lapsen-tari* about halfway between *Camps CXLVI* and *CXLVII*, is from three points of view of a certain interest. To begin with, it has the unmistakable *Chang-tang* character, more flat, more open, and with more distant views than the *Mü-chu* valley we have left behind. Secondly, it gives a perspective, to the S. S. E., south and S. S. W., of the range we crossed in the *Chesang-la*. Finally, it shows to the N. 55° W. the first glimpse one gets of the *Targo-gangri* from this road. A photograph of the »hla« at *Lapsen-tari* with a view to the N. 55° W. is to be found between pages 280 and 281 of Vol. III, though the peaks of *Targo-gangri*, by reason of the great distance, do not appear on the photo.

Our road to *Bumnak*, *Camp CXLVIII*, on *April 24th*, is 24.6 km. in length and proceeds in a nearly north-westerly direction. On this section one has again the impression of being on the *Chang-tang*. The first third of the road follows the right bank of the *Targo-tsangpo* to the entrance of the right tributary *Lung-chen*. On the second third the road crosses insensibly rising ground to the pass *Chumar-la*, 5,108 m. high and only 58 m. above *Kyang-dam*. From the pass we go down to *Camp CXLVIII*, *Bumnak*, with 4,945 m. On this section of 6.6 km., we fall 163 m. or as 1:40, a steep slope indicating the approach of the depression of *Dangra-yum-tso*.

Two panoramas taken on this road give an idea of the landscape. The first, Pan. 178, Tab. 32, is drawn at the confluence of the *Lung-chen* brook with *Targo-tsangpo*, and shows, to the S. 36° E., the valley of the Upper *Targo-tsangpo* by which we have come. To the S. 5° W. is Mount *Tasang*, to the S. W. Mount *Gip-chung*, to the S. 65° W., the comparatively considerable peak *Mukbo-chung*, to the S. 78° W. the valley by which the *Targo-tsangpo* goes down, soon turning to the N. W. and approaching the lake. To the W. N. W. is a mountain called *Kurtam*. The view from *Chumar-la* is represented on Pan. 173, Tab. 31. In its midst we see again *Mukbo-chung* and to the right of it N. 63° W., Mount *Bumnak*.

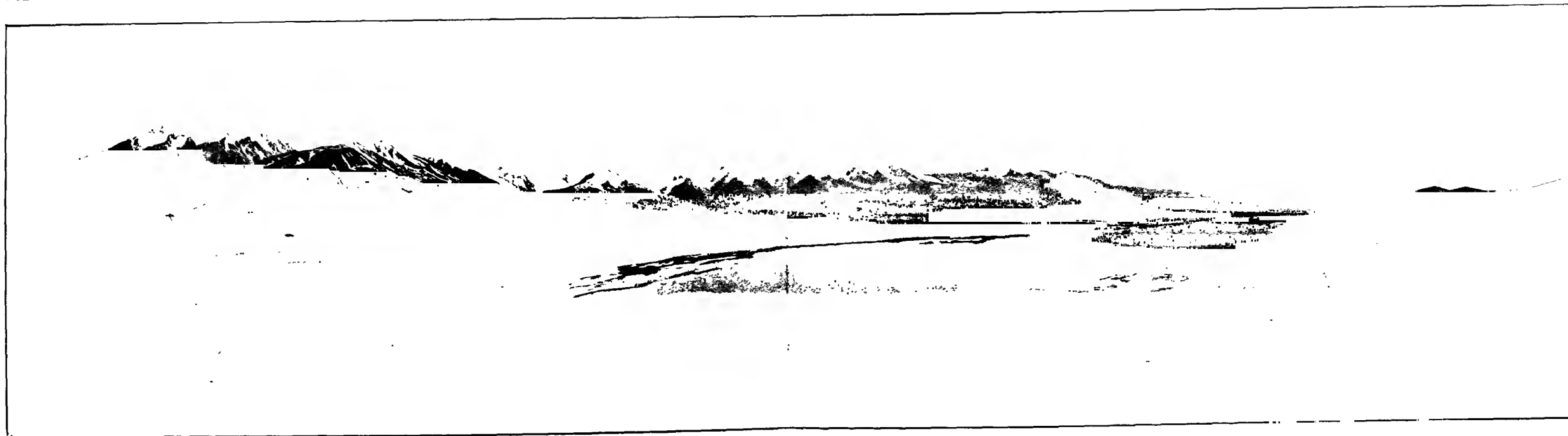
On *April 25th*, our road proceeds 1.8 km. W. S. W. to the pass *Ting-la*, 5,105 m. high or 160 above the *Bumnak* camp; the rise is, therefore, considerable or 1:11.2. The *Bumnak* is a tributary to the *Targo-tsangpo*. From the pass we have 10 km. N. W. to *Camp CXLIX* at *Kokbo* where the altitude is 5,110 m. On this section the road goes up and down.

On *April 26th*, we accomplished the last day's march on the second crossing. The road goes 4.5 km. W. N. W. to *Tarbung-la*, 5,267 m. high, a rise of 157 m., and a rate of 1:28.7. On the other side we had 16.2 km. N. W., descending 559 m. to *Camp CL* at *Targo-tsangpo*, being nearly the same slope as on the eastern side, or 1:29.

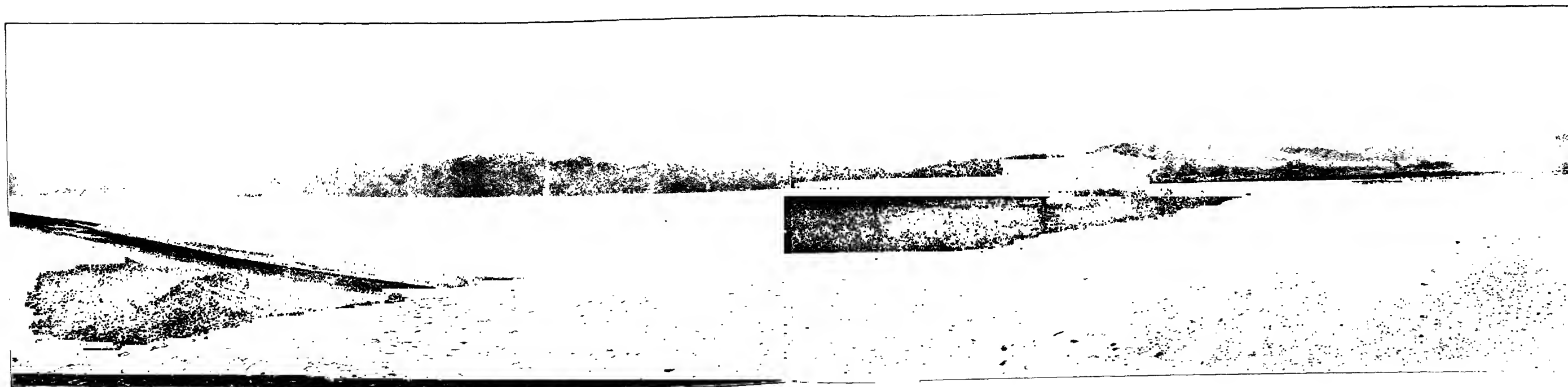
Three interesting panoramas were drawn on *April 26th*. The first, 172A and B, Tab. 31, is from the saddle of *Tarbung-la* and shows to the east a wavy sea of hills, near and distant. Amongst the mountains to the S. 29° W. the pass of *Sha-la* is pointed out by the guide. This information is, however, doubtful, as the pass according to other Tibetans was situated rather south of *Tarbung-la*. At any rate it seems no doubt to be on the continental water-parting, and, probably, on the same range as the *Chesang-la*, not on the same range as *Sela-la* and *Chang-la-Pod-la*, as I first believed. The most interesting view from *Tarbung-la* is the magnificent panorama of *Targo-gangri* unrolling its snow-covered and icy peaks from N. 73° W. to N. 37° W. The same view was photographed (Vol. III, between p. 280 and p. 281).







TARGO-GANGRI FROM A HILL AT 3.7 KM NORTH OF CAMP 150. (CP. PANORAMA 174).



VIEW TO THE W. N. W., N. W, NORTH AND N. N. E. FROM A POINT AT THE NORTHERN PART OF THE EASTERN SHORE OF SHURU-TSO, BETWEEN CAMP 151 AND CAM 152. IN THE BACKGROUND TO THE RIGHT TARGO-GANGRI IS IN SIGHT.





THE TARGO-GANGRI TO THE N. W FROM CAMP 150. TO THE RIGHT THE VALLEY DOWN TO DANGRA-YUM-TSO.



OUR YAK CARAVAN ON ANDEN-LA.



The second panorama of the same day, 181, Tab. 33, was drawn from a point 8 km. S.  $57^{\circ}$  E. of *Camp CL*. It gives nearly the same aspect of *Targo-gangri*, though some kilometers nearer, and it affords us with the first view we ever obtained of the *Shuru-tso* Mountains, which by some Tibetans were called simply *Gangri-do* and which seem to be a part of the Eastern *Lapchung Range*. A photo was taken from the same point of these mountains (Vol. III, between p. 280 and 281).

The third panorama, 177, Tab. 32, is from *Camp CL*, and embraces the whole view except *Targo-gangri* itself.

From a hill, *Nyemo-mari*, 4.2 km. north of *Camp CL*, Pan. 174, Tab. 31, was sketched, giving a view of the whole *Targo-gangri*. From the same point, Pan. 176, Tab. 32, is drawn, and a short distance south of it Pan. 175, Tab. 32, showing the old beach-lines. In Vol. III, after p. 282 I have several photos of the *Targo-gangri* from different points. Only on Pan. 174, *Dangra-yum-tso* was visible to the N.  $20^{\circ}$  W., but only as a thin, light line between the mountains.

According to the distances given above the whole second crossing of the *Transhimalaya* was 223.3 km. in length. The result at which I arrived in 1912 from the construction map was 223.7 km.<sup>1</sup>

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<sup>1</sup> Vol. III, p. 266.

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## CHAPTER XXVIII.

### THE THIRD CROSSING OF THE TRANSHIMALAYA.

In this chapter I intend to give the additional remarks to the description of my third crossing of the *Transhimalaya* which is to be found in Chapter XXXI of Vol. III. This journey across the system begins at *Camp CL* and comes to an end at *Camp CLXVIII* or the confluence of *Chaktak-tsangpo* and the great *Tsangpo*.

The first day's march, *April 30th*, takes us 12.3 km. S. W. and south, being a rise of 50 m. as *Tsangdam*, *Camp CLI*, is at a height of 4,758 m.; the rate is 1:246. Pan. 168, Tab. 30, shows the *Targo-gangri* in a foreshortened perspective from a point about halfway and situated at the S. E. base of the mountain, from where the highest peak in sight is at N. 62° W. Pan. 180A and B, Tab. 32, gives a topographically important view of the range west of *Shuru-tso*, called *Gangri-do*, or *Gangri-to* to the W. S. W. and S. W., the peak *Pungkar* to the N. 73° W., peak *Targo-rigüt* to the N. 40° W., the culminating *Targo-gangri* peak to the N. 16° W., *Tsangdam* camp to the N. E. and the hill *Tar-parva* to the S. E. and S. S. E.

The distance from *Camp CL* to *Camp CLI* along the *Targo-tsangpo* is about 11.1 km., and the fall of the river is therefore, as 1:222. If the distance from *Camp CL* to the southern shore of *Dangra-yum-tso* be considered to be 44 km., and supposing the fall of the river would be the same the whole way, it would amount to 200 m., and *Dangra-yum-tso* would be at an altitude of 4,508 m. But according to the general law of erosion and plateau-land morphology the rate of fall diminishes gradually, and it may be regarded as pretty certain that the lower course of the *Targo-tsangpo* has an extremely slow fall. On our map of 1:1 000 000 Colonel Byström has adopted the height of 4,646 m. for the lake, which is the altitude calculated from the observations of Nain Sing and entered (15,240 feet) on the map of Trotter. This observation seems to agree very well with my observations south of the lake. The altitude of Nain Sing becomes the more reliable if we remember that he has given to *Ngangtse-tso* an altitude of 4,683 m. which is very near the one I found, 4,694 m., after many days of observations. If the relations were the same in both cases, *i. e.* that the altitude of *Dangra-yum-tso* as given by the Pundit



TARGO-GANGRI FROM A POINT NEAR CAMP CL. (THE CONTINUATION TO THE RIGHT OF THIS PHOTO,  
VIDE Vol. III, p. 284).







SOME TIBETANS AT THE FOOT OF TAROGANGRI



were 11 m. too low, the real height would be, not 4,646 m., but 4,657 m. In the first case the fall would be as 1:709, in the second as 1:863, the latter being a fall of 51 m. in a distance of 44 km. If we compare this rate of fall with the relations at some other lakes belonging to the same lacustrine belt as *Dangra-yum-tso*, we will find that the gradient of slope is different at different lakes. The slope of the *Soma-tsangpo* from the point where I crossed it between my *Camps CCCCVII* and *CCCCVIII* and where the height is 4,792 m., down to *Teri-nam-tso*, which is at an altitude of 4,679 m., or on a distance of 101 km. along the river, the fall is 113 m. or 1:894, a value which indeed comes very near to the one calculated for *Targo-tsangpo*. Taking *Buptsang-tsangpo* from *Camp CCCCXX*, where the height is 4,776 m., down to *Tarok-tso* with 4,627 m., or 149 m. fall in 48 km., the rate becomes as 1:322 or nearly three times as steep. Along the *Sumdang-tsangpo* from *Camp CCCCXLI*, 4,785 m. high, to *Nganglaring-tso* 4,746 m., or a fall of 39 m. in a distance of 27 km., the rate is 1:693. However, the altitude of *Dangra-yum-tso*, or 4,646 m., is very likely to be correct.

On *May 1st*, we travelled 18.6 km. S. W. and S. S. W. to *Camp CLII, Parva*, on the eastern shore of *Shuru-tso*. The ground on this section is practically level, *Camp CLI* being at 4,758 m., and *Camp CLII* at 4,753 m. But on the road we cross the water-parting between the two lakes, being at 4,763 m. only, and so flat that it is impossible to tell its real situation. A secondary hill slope not far from the lake had even a height of 4,820 m.

From the last-mentioned place Pan. 179A and B, Tab. 32, was sketched. To the S. 70° E. the valley of *Targo-tsangpo* is seen between the mountains. Due south is the isolated Mount *Do-tsänkang* which, therefore, on Pl. 9 has been placed a short distance too far west. Then from S. S. W. and the whole way to the W. N. W. is the range west of *Shuru-tso* with the lake in the foreground. From N. 5° W. to N. 13° W. are some of the highest peaks of the *Targo-gangri*. Pan. 182A and B, Tab. 33, is drawn from *Camp CLII, Parva*, and shows *Do-tsänkang* S. 2° E. and then in a very beautiful perspective the mighty range on the western shore of the *Shuru-tso* with some of its names, as the *Napta* valley, *Umbu-tang*, *Umbu*, *Tangmupge*, *Parms-la* and *Tarlung*, and, of course, the whole surface of the lake in the foreground.

The altitude of the lake is 4,725 m. *Camp CLII* being situated on a terrace along the shore had 4,753 m. The distance to *Camp CLIII, Kyangdam*, is 12.4 km. and the altitude at the camp is 4,739 m. From here the Pan. 183A, B and C, Tab. 33, was drawn. By a curious mistake in the plotting of the panoramas for reproduction, *Targo-gangri* appears twice. It should, therefore, be noticed that Pan. 183A begins from S. 51° W. Then follows to the right a new, more fore-shortened perspective of the *Gangri-do* Range on the western shore of the lake.

From N.  $5^{\circ}$  E.<sup>1</sup> to N.  $14^{\circ}$  E. the *Targo-gangri* is again visible, on a diminished scale. To its right follow the mountains to the east and S. E. of the lake. To the S.  $30^{\circ}$  E. is the valley of *Kyangdam-tsangpo*; to the S.  $8^{\circ}$  E. is the highest peak of the *Do-tsänkang* Mountain,<sup>2</sup> and to the right of it some distant hill and a small hill in our vicinity. The dark mountain at the right end of Pan. 183C is the same as the one to the S.  $51^{\circ}$  W. on Pan. 183A. The only difference is that the sun had been sinking in the meantime and the shadows covered these mountains before I had completed the panorama all around.

On *May 4th*, our road goes S. W. and S. S. W. for 18.7 km. to *Camp CLIV*. The first 4.7 km. take us up to the pass *Dunka-la* with an altitude of 5,030 m. The rise is, therefore, 291 m., or 1:16. *Camp CLIV*, *Sabuk*, is at 4,947 m., or 83 m. lower than the pass, and the fall 1:171. From *Sabuk*, Pan. 184, Tab. 33, is drawn showing a glimpse of *Targo-gangri* to the N. N. E.

On *May 5th*, our road continues south and S. S. W. The first 3.7 km. take us to the pass *Bäng-la*, 5,237 m. high, and 290 m. above *Camp CLIV*. The ascent is rather stiff or as 1:12.7. From the pass we have 7.2 km. to *Camp CLV*, *Angjum* with an altitude of 5,186 m.,<sup>3</sup> or 51 m. below the pass, a rate of fall as 1:141. From *Bäng-la* Pan. 185A and B, Tab. 33, was sketched, giving a strong impression of rather massive and mighty ranges to the west and north, all belonging to the *Transhimalayan System*. The snow-covered range to the west may be a part of, or rather the eastern end of, the *Kanchung-gangri*. The *Gangri-do* with the snow-covered *Gablung-pu* appears in a still more foreshortened perspective than hitherto. To the N.  $11^{\circ}$  E. and N.  $19^{\circ}$  E. is the *Targo-gangri* in a still more diminished scale. To the left or west of it, N.  $6^{\circ}$  E., is a mountain which seems to be a range parallel to and situated just west of the *Targo-gangri*. To the right or east of the latter, one sees the depression in the northern continuation of which the *Dangra-yum-tso* is situated.

The next section of the road again takes us over the continental water-parting in *Angden-la*, *May 6th*. The pass is double, the first saddle being 5,634 m. high, the second is 5,643 m. high. The distance to the latter, from *Camp CLV* is 6.4 km., the elevation 457 m., and the rate 1:14. From the pass to *Camp CLVI*, *Kyam*, or *Kiam* at 4,954 m., the distance is 12.6 km. Here the ground sinks 689 m. or at a rate of 1:18.3.

Pan. 187, Tab. 34, is taken from the first threshold of *Angden-la*, giving a last view of the *Targo-gangri* and the world of mountains to the west and S. W.

<sup>1</sup> Not N.  $9^{\circ}$  E. as on the Pan.

<sup>2</sup> A sketch of the same mountain is to be found between p. 272 and p. 273 of Vol. III.

<sup>3</sup> On Pl. 9 it is 5180 which is a mistake for 5186.

of it. Pan. 186, Tab. 34, is taken from the second threshold and represents the landscape to the south. Pan. 189A and B, Tab. 34, is a view from *Camp CLVI*, giving a good perspective of the range we had just crossed in the *Angden-la*, probably the same in which the *Sha-la* is situated. To the N.  $47^{\circ}$  E. is Mount *Ira* with *Ire-lungpa* from where the *Kyam-chu* comes down. To the E. S. E. are the mountains *Tambe* and *Kintang*. To the south is the *Amchok-tang*, or plain surrounded with its mountains.

The plain of *Amchok* falls very gradually to the south, and our next march, on *May 7th*, to the S. S. W. on this plain, descends only 84 m. or to 4,870 m. at *Camp CLVII*, at *Hramsang*, on the N. W. corner of *Amchok-tso*. The rate is 1:205. Pan. 188, Tab. 34, is taken from *Amchok-yung* a few kilometers north of *Hramsang*. It is of importance as showing how very difficult it is to solve the orographical problems of the *Transhimalaya* with the material I was able to bring home. Nobody should wonder at this fact. I have only crossed the system on a few lines. Even the *Himalaya* which has been so thoroughly explored, mapped and measured, is orographically not quite known. On the panorama in question we have a range to the north and N.  $20^{\circ}$  E., certainly the one of *Angden-la* to the north of *Amchok-tang*. N.  $30^{\circ}$  E. is *Do-tsänkang* from this side also cropping up as a solitary peak. The *Kintang*, N.  $70^{\circ}$  E., seems to belong to a special range, situated south of the one with *Sha-la*. In front, or south, of it is another range, which S.  $76^{\circ}$  E. has a first snow-covered pyramidal peak, and to the S.  $57^{\circ}$  E., S.  $48^{\circ}$  E., S.  $36^{\circ}$  E. and S.  $30^{\circ}$  E. a series of other, very considerable peaks. The question is whether this range may represent the western end of the *Nien-chen-tang-la*, but this problem can only be solved by detailed exploration on the spot.

Pan. 193A and B, Tab. 35, from *Camp CLVII*, *Hramsang*, gives another aspect of the surrounding mountains. To the west and N. W. are the mountains *Puchu* and *Ngingri*, to the north the range of *Angden-la*, to the east is the northern-most part of *Amchok-tso*, and to the E. S. E. and S. E. Mount *Shakokshar*, probably a part of the same range which I supposed to be the western continuation of *Nien-chen-tang-la*. The mountains visible to the S. S. E. are situated between the *Raga-tsangpo* and the great *Tsangpo*. Finally Pan. 191, Tab. 35, is a little view to the S. E. from the southern shore of *Amchok-tso*, and Pan. 194, Tab. 35, a view to the N. W. and north, across the lake from the same point.

On *May 10th*, we travelled 9 km. to the west and south, rising 440 m. to *Camp CLVIII*, *Serme-lartsa*, which is at 5,310 m. The rate is 1:20.4.

The next day's march, on *May 11th*, we had 5.3 km. S. S. W. to the pass of *Sao-lungring*, 5,387 m. high, or 77 m. above the last camp, the rate being 1:68.9. Then follow 9 km. sinking and again rising ground to a second, nameless, pass with an altitude of 5,384 m. From this secondary threshold we had only 3.2 km.

to *Camp CLIX* or *Tsarok*, where the altitude is 4,861 m. On this last section the road went very steeply down to the valley of *Raga-tsangpo*, a fall of 523 m. or 1: 6.1. From a point just south of *Sao-lungring* a sketch was drawn, Pan. 192, Tab. 35. Pan. 190A and B, Tab. 34, is a view of the hills around *Tsarok*.

On *May 12th*, we travelled 17.8 km. W. S. W. along the *Raga-tsangpo* to *Camp CLX*, or *Yo'on*, 4,919 m. high, a rise of 58 m. or as 1: 307, showing a very gradual slope for the *Raga-tsangpo*. From a very flat little secondary threshold on the road, Pan. 195, Tab. 35, was drawn. To the S. 87° W. it shows the upper part of the valley of *Raga-tsangpo*, and then, to the right the comparatively not very high mountains north of the river. To the N. 2° E. is a pyramidal peak called *Kungri-rakpe*.

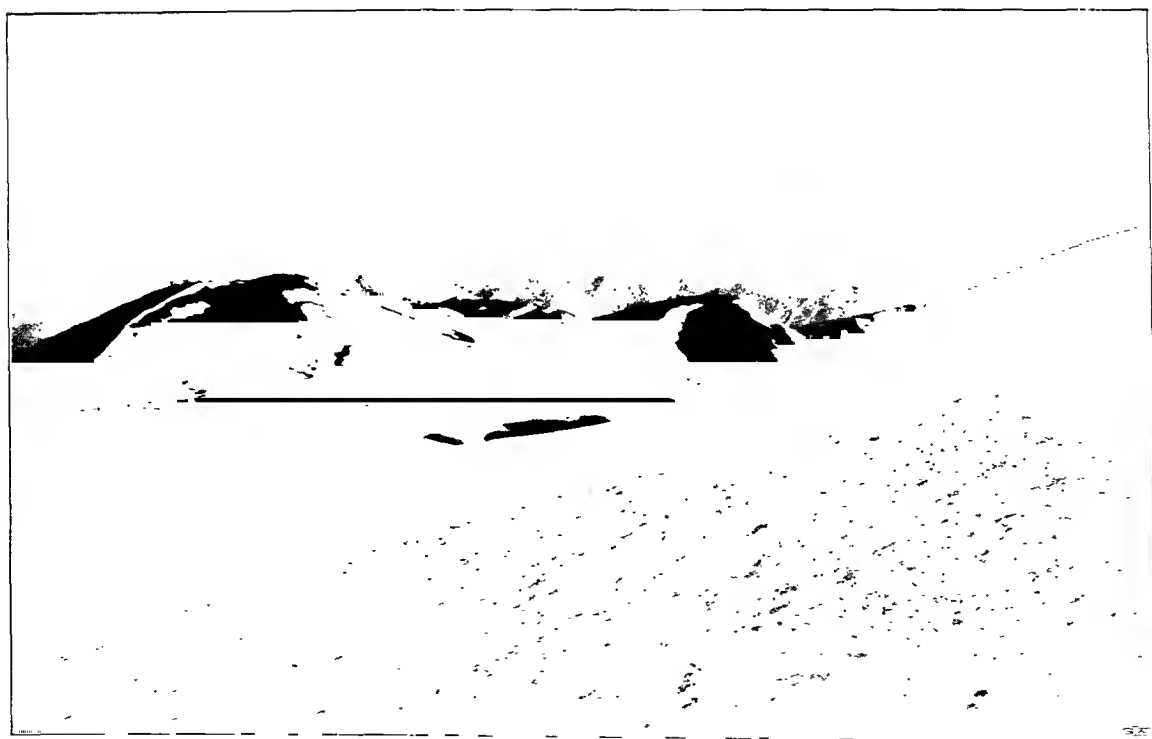
Next day the distance was 12.7 km. S. W. to *Camp CLXI*, *Raga-tasam*, with an altitude of 4,948 m., 29 m. above the previous camp, or a rise of 1:438. The panorama, 197A and B, Tab. 36, taken from *Raga-tasam*, is of interest. Already from the little threshold west of *Tsarok*, a first glimpse had been caught of the *Chomo-uchong* to the S. 87° W. Now we got a clearer view of the same mountain to the N. 83° W. To the N. 69° W. at a considerable distance a rather high mountain was in sight, and N. 25° W. rose the mighty mount of *Lombo*, a name that practically may be the same as *Lunpo*, as the high peaks farther west were called, though the pronunciation, if this be the case, is different. *Ngangba-kanja* was the name of the mountains to the east and E. N. E. situated south of *Raga-tsangpo*. *Yosar* is another name of mountains in connection with the former and to the E. S. E. and S. E.

On *May 21st*, the road continues 16 km. W. N. W. to *Camp CLXII* at *Chosang-jung*, where the altitude is 5,006 m. or 58 m. above the previous camp and a rise of 1: 276. At this place we have to consider Pan. 196A and B, Tab. 35. The range of *Lombo* visible to the north, is probably the same which I crossed a year later in *Gyägong-la*. To the east and E. S. E. is seen the broad valley of *Raga-tsangpo*. S. 64° W. is *Chi-ke lung*, to the west is *Ravak*, to the N. 60° W. Mount *Kichen-talung-changri*, to the N. 54° W. *Semo-tandung*, and to the N. W. *Semo-changri*. It is easy to sketch the outlines of all these hills as they present themselves, but it is a very difficult task to arrange them correctly in relation to one another on a map. For this purpose detailed survey work in all the more considerable valleys is necessary, and my map is only a preliminary one.

From *Camp CLXII*, we begin to ascend in a W. N. W. direction the outskirts of the mountain group of *Chomo-uchong*. On *May 22nd*, the march was 6.6 km. to *Ravak-la*, 5,227 m. high, a rise of 221 m. at a rate of 1:30. From the pass we had 1.1 km. to *Camp CLXIII* at *Kichung-sumna*, 5,198 m. high, or 29 m. below the pass, a rate of fall as 1:34. On Pan. 198A and B, Tab. 36, the *Chomo-uchong* proper is still hidden. At S. 75° W. the way to *Kichung-la* is visible. To the



THE CHOMO-UCHONG FROM A POINT SITUATED AT A SHORT DISTANCE S. E. OF KICHUNG-LA.  
LOOKING WEST AND W. N. W.



THE CHOMO-UCHONG FROM A POINT SITUATED AT A SHORT DISTANCE N. W. OF KICHUNG-LA.  
LOOKING W. S. W. AND WEST.







THE VALLEY CHUNG-SANG. LOOKING S. S. W. FROM A POINT N. W. OF KICHUNG-LA



THE VALLEY OF SA-CHU AT SAKA-DSONG. INTERMENT OF ONE OF MY MEN.





ONE OF OUR CAMPS IN SOUTHERN TIBET.





THE CONFLUENCE OF THE TSANGPO AND THE CHAKTAK-TSANGPO FROM A LITTLE THRESHOLD AT CAMP 168.  
THE HIGHEST PEAK, KIA, BETWEEN THE TWO RIVERS, IS SEEN TO THE S 71° W.









THE CONFLUENCE OF THE TSANGPO AND THE CHIAKFAK-TSANGPO FROM A LITTLE THRESHOLD AT CAMP 168  
(CONTINUATION TO THE RIGHT OF THE FOREGOING PHOTO). LOOKING N 75° W UP THE VALLEY OF THE CHIAKFAK-TSANGPO.



N.  $48^{\circ}$  W. the *Kichen-talung-changri* is again in sight. To the N. N. E. is the range *Lombo* and to the N. E. *Tsopti*.

The march of *May 23rd*, took us through a complicated region. First we had 3.4 km. S. W. to *Kichung-la*, 5,504 m. high, a rise of 306 m. at a rate of 1:11. Then we had 3 km. undulated high-alpine ground, descending to a brook, ascending to a second pass of 5,480 m., and then up to a third pass, *Kanglung-la*, of 5,528 m. Finally 3 km. W. N. W. to *Camp CLXIV, Lungle*, which is at 5,251 m. or 277 m. lower, a rate of fall as 1:10.8. A series of small panoramas were drawn. Pan. 203, Tab. 37, is from *Kichung-la* to the E. N. E. and east over a hopeless labyrinth of mountains more like a stormy sea. From the same pass a more elaborate panorama, 204, Tab. 37, embraces the whole group of *Chomo-uchong* with culminating peaks to the S.  $34^{\circ}$  W., S.  $55^{\circ}$  W., S.  $75^{\circ}$  W., S.  $86^{\circ}$  W., N.  $87^{\circ}$  W. It should be compared with a photo on the opposite page. Pan. 201, Tab. 37, is taken from the second pass, looking back to the *Kichung-la* S.  $87^{\circ}$  E., S. E. and S. S. E. Pan. 199, Tab. 36, is from *Kanglung-la* with, to the N.  $60^{\circ}$  W., the valley down to *Lungla* amongst waves of mountains. Finally Pan. 200, Tab. 36, taken from *Camp Lungle*, shows to the S. S. W. and S. W. some of the high peaks of *Chomo-uchong*, and to the N.  $61^{\circ}$  W. the *Rongchen* valley going down. I think it is no exaggeration to say that these panoramas tell a good deal more than the map, or rather, that the map is a lifeless record if it is not assisted by these landscape views.

On *May 24th*, we go down 14.5 km. W. N. W. and S. S. W. to *Camp CLXV, Pang-satak*, with an altitude of 4,916 m. The fall is 335 m. and the rate 1:43.3. The next day's march was 7 km. in length to *Camp CLXVI, Basang*, where the height was 4,796 m. The fall is 120 m., the rate 1:58, and the direction S. W. Pan. 208, Tab. 38, is taken from *Basang*. Its most interesting part is Mount *Lumbo-taktsen*, which is a part of *Chomo-uchong*.

On *May 27th*, the march goes S. S. W. in a nearly straight line crossing the *Sa-chu* which is a left tributary to the *Chaktak-tsangpo*, and ascending the *Gyabuk-la*, 4,823 m. high. The distance to the pass being 8.9 km., and the rise only 27 m., the rate is 1:329. On the southern side we had 6.8 km. to *Camp CLXVII, Kyärkyä*, 4,575 m. high, or a descent of 248 m. at a rate of 1:27.4. Pan. 206, Tab. 37, from *Gyabuk-la*, shows the mountains to the north and south, and in the middle, a new aspect of the *Chomo-uchong* with three pyramidal peaks, *viz.*, N.  $45^{\circ}$  E. the *Lumbo-taktsen*, N.  $55^{\circ}$  E. the *Tsummo*, and N.  $60^{\circ}$  E. the *Chomo-uchong* proper.

The last march, *May 28th*, is 10.8 km. south and west, first going down the *Kyärkyä* valley and then ascending along the northern bank of the great *Tsangpo* to the confluence of the *Chaktak-tsangpo*, at *Camp CLXVIII*. From a slope close upon the latter camp, Pan. 207, Tab. 37, was sketched showing the appearance of the mountains around the confluence of the two rivers. To the S.  $61^{\circ}$  E. the great

valley of the joint river goes down on its way eastwards between the *Transhimalaya* and *Himalaya*. *Unggung-gäbri* and *Älung* are mountain shoulders to the S. S. E. and S. To the S.  $31^{\circ}$  W. is seen the valley by which the great *Tsangpo* comes to the confluence with Mount *Kha* to its west. To the N.  $75^{\circ}$  W. is the valley of the *Chaktak-tsangpo* coming down to the confluence. Pan. 205, Tab. 37, is drawn from *Camp CLXVIII* showing the valley of the great *Tsangpo* above the confluence, and practically the same view as S.  $31^{\circ}$  W. on Pan. 207 only under a somewhat changed perspective.

The whole distance of the third crossing, according to the marches given above, is 247.2 km. The first calculation, found on p. 289 of Vol. III, was 237.9 km. as measured on the construction map. Thus, in spite of the violence exerted upon the original map for entering it in the net of co-ordinates, the two maps agree in a satisfactory way.

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## CHAPTER XXIX.

### ALONG THE UPPER TSANGPO TO THE MANASAROVAR.

In Vol. III my eight journeys across the *Transhimalaya* were arranged in geographical order, from east to west. Here, on the other hand, I deal with them chronologically. Therefore the journey from *Khaleb* to *Yumba-matsen*, which was the seventh in Vol. III, will be the fourth here. However, it is a long way to *Khaleb*. We cannot leave all the panoramas drawn along the road without saying a few words of them. Some of them will tell us, amongst other things, how much the three expeditions that have travelled before me in the *Tsangpo* valley, *viz.*, Desideri and Freyre, Nain Sing, and Ryder, have been able to see of the *Transhimalaya*. The panoramas to the north will prove how impossible it is to draw any conclusions regarding the orographical arrangement of the different ranges, and in how far the view may be justified, as maintained by some geographers who have never been in the country, *viz.*, that one continuous range is running the whole way along the northern side of the *Tsangpo* or *Upper Brahmaputra* valley. We will thus have to proceed, day by day, westwards along, or at the sides of, the *Tsangpo* to its source and *viâ* the *Sacred Lake* to *Khaleb* at the foot of the *Kang-rinpoche* or *Kailas*, from where the fourth journey across the *Transhimalaya* starts.

The first march from the confluence on *May 30th*, takes us 13.1 km. W. N. W. along the *Chaktak-tsangpo* to *Takbur*, *Camp CLXIX*, where the altitude is 4,532 m.<sup>1</sup> The rise is thus only 8 m. or 1:1,638. Pan. 212, Tab. 39, is taken halfway from a *mani* on the road, and shows once more the massif called *K'ha*, and to the west and W. N. W. the perspective up the valley of *Chaktak-tsangpo*. Pan. 213, Tab. 39, is also a view to the west taken from *Camp CLXIX*.

On *June 1st*, the road goes north and E. N. E. to *Camp CLXX*, *Saka-dsong*. The first 7 km. take us up to *Takbur-la* at 5,066 m. or a rise of 534 m., or 1:13. From the pass we descend 450 m. in 14.8 km. to the next camp where the altitude is 4,616 m. The rate is here 1:33, showing that even here the southern slope is the

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<sup>1</sup> The 4521 on Pl. 10 is incorrect.

steeper. The panorama, 210A and B, Tab. 38, from *Takbur-la*, shows to the S. S. E., south, and S. W. mountains between the *Chaktak-tsangpo* and the great *Tsangpo*, and to the S. W. at a great distance, one of the northern *Himalaya* Ranges with a more dominating peak. To the N. W. it gives a perspective of mountains and peaks belonging to the *Lunpo-gangri*, and to the north and N. N. E. the *Kanchung-gangri*. It will in every single case be a great assistance to compare the panoramas with the map in 1:1000000. Pan. 209A and B, Tab. 38, from a terrace a few kilometers W. S. W. of *Saka-dsong*, has to the S. S. W., west and N. W. the *Karkong* valley, and to the N. 52° W. its junction with the *Sa-chu* valley. To the north and N. E. it shows a bulky range bordering the *Sa-chu* valley on the north. Eastwards some of the *Chomo-uchong* peaks are again visible. Pan. 211A and B, Tab. 38, is a drawing of all the mountains surrounding *Saka-dsong*. To the S. 79° W. is the valley of *Sa-chu*, going down to its confluence with the *Chaktak-tsangpo*.

On *June 7th*, we travelled westwards 15.7 km. to *Camp CLXXI, Targyaling-gompa*, at 4,574 m. or 42 m. below *Saka-dsong*, a descent of 1:374. On Pan. 215A and B, Tab. 39, we see, to the S. S. W., the valley of the *Chaktak-tsangpo* going to the confluence with the great *Tsangpo*. S. 80° W. is a valley called *Hlalung*. Before reaching that our road the next day turned to the right or north. To the N. W. is the monastery *Targyaling-gompa* on its hill slope, and to the N. 2° W. is a short-cut through the *Tsalung* valley to *Pasa-guk*. The main branch of the latter valley seems to come from the mountains *Tingoa* and *Tingo-shar*.

On *June 8th*, the road continues west and north along the *Chaktak-tsangpo* to *Camp CLXXII, Pasa-guk*, with 4,586 m., or 12 m. higher than the previous camp, a rate of 1:725 on a distance of 8.7 km. Pan. 220, Tab. 40, is a view of the mountains to the N. N. E., N. E., and E. S. E. from *Pasa-guk*.

The next day, *June 10th*, we had 15.6 km. W. N. W. along the *Chaktak-tsangpo* and its tributary, *Rok*, to *Camp CLXXIII, Churu*, 4,628 m. high, or a rise of 42 m. at a rate of 1:371. On Pan. 214, Tab. 39, the valley to the S. 25° W. is called *Markyem*, and to the N. 83° W. is the valley which continues to *Nyuku*. Pan. 217, Tab. 39, is a view east from the same place, and Pan. 216, Tab. 39, taken from the confluence of the *Rok* and *Chaktak*, shows a beautiful perspective to the N. E. called *Luma-nakchen-nakchung* and belonging to the *Kanchung-gangri*. It should be compared with the mountain to the N. 1° E. from *Takbur-la*, as seen on Pan. 210A, Tab. 38. It is again visible from *Lamlung-la* to the N. 37° W., Pan. 483, Tab. 90. It is no doubt the same which appears to the S. 14° W. from *Sang-bertik*, Pan. 485B, Tab. 90.

The march of *June 11th* continued W. N. W., 10.8 km., to *Camp CLXXIV, Rok-shung*, at 4,609 m., a fall of 19 m., or as 1:568. There is a water-parting between *Camp CLXXIII* and *Camp CLXXIV*, though it was impossible to tell

where it was. The figure 4,622 m. for the altitude west of the latter camp is, no doubt, too low. Pan. 218, Tab. 39, shows, to the W. S. W., the continuation of the valley we had to travel the next day. To the N. W. are very high mountains called *Lombo-kangra* by our Tibetans, though *Lunpo-gangri* was the name given by nomads farther north. To the north and N. E. are the bulky mountains bordering the valley. From the north extending eastwards is the valley by which we have arrived.

On *June 12th*, we travelled W. S. W. 15.1 km. to *Camp CLXXV*, *Nyuku*, at 4,600 m., or 9 m. below *Camp CLXXIV*, a rate of 1:1,677. The rate of fall in the northern side valleys is, therefore, very gradual. From *Nyuku*, Pan. 219, Tab. 40, was drawn. To the S. 9° E. it has Mount *Chagdang*, to the S. 9° W. Mount *Peling-nagmo*, to the S. W. the valley of *Men-chu*, going down to the *Mar-tsang-tsangpo* or great *Tsangpo*, just west of Mount *Shiri-nakto* W. N. W. and N. W. is Mount *Balsang*. N. 30° W. is the valley of the Upper *Men-chu* and N. 2° W. is Mount *Nyuku-tombo*.

On *June 14th*, we had 15.2 km. N. W. up the *Men-chu* valley to *Camp CLXXVI*, *Kyum-ngoya*, at 4,670 m., or a rise of 70 m. at a rate of 1:217. The little panorama 222, Tab. 40, is taken from there showing the valley of *Men-chu* by which we arrived.

The next day, *June 15th*, took us 10.3 km. N. W. farther up the same valley to *Camp CLXXVII*, *Konak*, at 4,729 m., or a rise of 59 m., and a rate of 1:175. From this camp a complete panorama was taken. The most important part of it are the high peaks to the N. N. E. and N. E. some of which had been seen and measured by Wood of Ryder's Expedition in 1904. Those visible from *Konak* were called, by my Tibetans, *Chaslung-kang*, *Lombo-kangra* (*Lunpo-gangri*), and *Tsumo-sora-yang* — the *Shäkyung* being situated at a shorter distance. To the west are the *Särchung* peaks and *Särchung-la* which we later on had to cross.

From *Konak* I made an excursion N. N. E. and N. E. 14.6 km. to *Kilung-la* at the S. W. base of *Lunpo-gangri*, where the altitude was 5,318 m. The rise, therefore, amounted to 589 m., a rate of 1:25. The panorama, 226A and B, Tab. 41, taken from *Kilung-la*, is important and should be compared with the several panoramas of the same mountains as seen from the north, some of them already communicated in Vol. III. S. 38° W. is *Särchung-la* with our road to *Tradum*. It is worth noting that the mountains to the W. N. W. and N. W., the drainage area of *Tsa-chu-tsangpo*, give the impression of being comparatively low, which is perfectly in accordance with my other orographical observations. A view to the N. W. from such a commanding place as *Kilung-la*, will run parallel with the stretching of *Lunkar-gangri* and *Lunpo-gangri*, that is to say, in the valley between it and the next parallel range to the west. To the N. 34° W. is the peak *Chaslung-kang*, to the N. 33° E. the *Lunpo-gangri*, and to the N. 48° E. a less important peak, *Kilung-nagmo*.

On *June 17th*, we had first 7 km. W. S. W. to *Särchung-la*, 5,188 m. high, or 459 m. above *Konak*. The rate is thus 1:15. On the other side we had 12.5 km. S. W and west to *Camp CLXXVIII*, *Dambok-rong*, 4,657 m. high, or a descent of 531 m. from the pass, being a rate of 1:23.5. From *Särchung-la* Pan. 228, Tab. 41, was drawn, showing to the N. E. some of the magnificent *Lunpo-gangri* peaks, and a group of mountains to the E. N. E. also belonging to the same system and being the S. E. continuation of the *Lunkar Range*. To the S. W. and W. S. W. on Pan. 229, Tab. 42, we have also a fine view of the water-parting *Himalaya Range* south of the great *Tsangpo*.

Pan. 223<sup>A</sup> and B, Tab. 40, from *Dambok-rong* gives an idea of the mountains all around the place. S. 66° E. is the valley by which we arrived. S. 53° W., and round the corner, our road proceeds to *Tradum*.

The next march, *June 18th*, takes us 12.1 km. west to *Tradum*, 4,591 m. high, or a descent of 66 m., at 1:183. From a point a few kilometers east of *Tradum*, at a »hla« near the base of a northern rocky promontory, Pan. 224<sup>A</sup> and B, Tab. 41, was drawn, showing comparatively low hills, but many names. The word *Tasang* S. S. E. is obviously no name, but simply *tasang* or *tasam*, the great road. From *Tradum* itself Pan. 225<sup>A</sup> and B and Pan 227, Tab. 41, were drawn, all three belonging together without interruption. From S. 21° W. to S. 58° W. they show a considerable snowy range, the water-parting *Himalaya*. Just in front of this range and turning to the left, we had to travel towards S. 21° W. the next days. To the N. 67° W. is the valley of the great *Tsangpo*. To the N. 40° W. is the valley of the *Tsa-chu-tsangpo*. To the N. E. is the monastery of *Tradum* and to the S. E. a solitary *chorten*. This panorama was taken some 800 meters west of the camp.

On *June 20th*, our road goes due south for 10.6 km. to the *Tsangpo*, or Upper *Brahmaputra*, at *Liktse-gompa* where the altitude is 4,565 m. or 26 m. below *Tradum*, a rate of fall of 1:408. Here the *Tsa-chu-tsangpo* comes in from the N. W. From this place Pan. 231<sup>A</sup> and B, Tab. 42, was drawn to show the entire horizon. To the N. W. is the broad, open valley of the *Tsangpo*. N. 60° E. the *Tsangpo* turns to the east. N. 76° E. is the hill of *Liktse* with its *gompa*, also seen on a photo between p. 318 and 319 of Vol. II, and S. 68° W. is the Peak *Rungona*.

On *June 21st*, we travelled 33.8 km. S. W. and south to *Camp CLXXXI* where the altitude is 4,595 m., or 30 m. above *Camp CLXXX* on the *Tsangpo*. The rise is, therefore, extremely gradual, or as 1:1127. In the first section of this road the low thresholds, *Tsasa-la*, *Dorap-la* and *Ngurkung-la* were crossed. From the second of these Pan. 230, Tab. 42, was sketched showing the third threshold, *Ngurkung-la* to the S. 33° W., and to N. 88° W. *Dikpa-nakchir*, a small peak, at the western side of the broad entrance to the *Nachalak Plain*. The Pan. 237, Tab. 43, from *Camp CLXXXI* is interesting so far as it gives an idea of the







VIEW TO THE S. S. W. AND S. W. FROM KORE-LA. (CP. PANORAMA 233, B).



extreme flatness of *Kore-la* to the south. As a matter of fact one does not at all get the impression of a pass from the northern side; it looks as if the plain continued with insensible undulations, or rather, quite level to the south. To the S. W., west, and N. W. is the perspective of the northern *Himalaya Range*, most of it, unfortunately, hidden by clouds.

On *June 22nd*, we crossed the pass *Kore-la*, which, at the *mani* cairn,<sup>1</sup> has an altitude of 4,637 m.,<sup>2</sup> but on the water-parting itself 4,661 m. If we consider the first-mentioned figure, the rise from *Camp CLXXXI* to the pass, 3.3 km. distant, would be 42 m., or 1:78.6. From the pass to *Camp CLXXXII*, *Nama-shu*, in *Nepal*, where the altitude is 3,806 m., the fall would be 831 m., or as 1:17. The altitude 4,661 m. for the pass was found on the way back. To *Nama-shu* the direction is south, S. E., and south and the distance 14.1 km.

Pan. 232A and B, Tab. 42, is taken from *Kore-la*. The view is to the E. S. E., south, and W. S. W. in the direction of *Nepal*. Again a distant view is very much hindered by clouds. Pan. 234A and B, Tab. 43, is taken from *Camp CLXXXII*, *Nama-shu*. It is a view of the valley down through the *Himalaya* to the south. To the S. W., west, and N. N. W. is the wall of mountains and terraces along the right side of the valley. To the north is the valley by which we have come, to the N. E. the valley, and to the E. N. E. is a house in *Nama-shu*. Pan. 243, Tab. 44, is taken from a point on the road not far from *Camp CLXXXII*.

The road back, on *June 23rd*, to *Kore-la* is the same as on the previous day. From the pass to *Kung-muge*, *Camp CLXXXIII*, 4,603 m., the distance is 6.2 km., the fall 58 m. from the 4,661 m. threshold, and the rate 1:107. Pan. 233A and B, Tab. 42, is a second view drawn from the pass. The most important part of it, or the view down to *Nepal*, is hidden by clouds. To the north the sky is clear the whole way in the direction of the *Tsangpo*. The view to the north from *Camp CLXXXIII*, Pan. 238, Tab. 43, shows that we are returning again to the more flat plateau-land. To the N. N. E., at a great distance, even the *Transhimalaya* may be seen as a contour line.

The next march, *June 24th*, took us 24.8 km. N. N. W. to *Camp. CLXXXIV*, *Bando*, at an altitude of 4,594 m., or a fall of only 9 m., being a rate of 1:2,755. It should, however, be noticed that the ground on the last section of this march, again rises. Here a little threshold, *Chasang-la*, is crossed at an altitude of 4,551 m. From this little pass Pan. 239A and B, Tab. 43, was drawn, showing to the south the little valley by which we had ascended, and to the S. W., west, and N. W. the *Himalayan* Mountains which from the west border the plain of *Nachalak*. To the

<sup>1</sup> Between p. 320 and p. 321, Vol. II, there are a few photos from this place.

<sup>2</sup> The figure 4,620 m. on Pl. 10 is wrong. It should be 4,637 m.

N.  $30^{\circ}$  W. is the Mountain *Dikpa-nakchir*, and to the N.  $13^{\circ}$  W. *Kitsa-rinak*, a group we would leave to our right the next day. To the N. N. E. are *Trans-himalayan* Mountains belonging to the *Lunkar Range* and to ranges west of it. The peak *Chamda-shumo* to the N.  $26^{\circ}$  E. is the same one as could be seen already from *Camp CLXXXIII*, at about N.  $20^{\circ}$  E. on Pan. 238, Tab. 43. To the N.  $58^{\circ}$  E. we have a fine, though distant view of the highest peak of the *Lunpo-gangri* (*Lombo-kangra*).

On *June 25th*, we travelled N. W. 10.2 km. to *Camp CLXXXV*, *Chikum*, where the altitude is 4,796 m. The rise is 202 m., and the rate 1:50.5. From the latter camp Pan. 235, Tab. 43, is taken, showing rounded and moderate hills to the west. Pan. 236, Tab. 43, is a view to the east showing the *Tsangpo* and a part of the plain to the south of the great river.

On *June 26th*, the direction is N. W. First it is 1.6 km. to the pass *Tagu-la* 5,026 m. high, a rise of 230 m., and a rate of 1:7, one of the steepest gradients we ever had. On the western side we had 9.5 km. to *Camp CLXXXVI*, *Tambap*, 4,785 m. high, a rise of 241 m. at a rate of 1:39. Pan. 240, Tab. 44, is a view from *Tagu-la*, showing to the N.  $32^{\circ}$  W. a peak called *Tambap*, to the N.  $32^{\circ}$  E. *Kitse-rinak*, to the N.  $78^{\circ}$  E. the eastern part of *Lunpo-gangri* just peeping out in the interval between two hills. To the S. W. are ranges belonging to the *Himalaya*. Pan. 245, Tab. 44, catches only the *Himalayan* Mountains so far as they are in sight from a point in the immediate neighbourhood of *Tagu-la*, and to the north of it. Pan. 242, Tab. 44, is taken from a point 2 km. east of *Tambap*, and embraces the plain of *Närung-tsangpo* with surrounding mountains. Pan. 241, Tab. 44, finally, is taken from *Camp Tambap* itself and shows to the S.  $87^{\circ}$  E. the road by which we came down from *Tagu-la*.

The next march, *June 27th*, proceeds W. N. W. and N. W. 17.3 km. to *Camp CLXXXVII*, *Nagor*, at an altitude of 4,608 m., or 177 m. below *Camp CLXXXVI*, the rate of fall being as 1:98. The Pan. 246A and B, Tab. 44, from *Nagor* includes the whole horizon. The mountains to the N. E. and east are called *Tirok*. To the S.  $70^{\circ}$  E. is our road from *Tagu-la*. To the S.  $35^{\circ}$  E. is a snow-covered mountain called *Närung-gangri*. To the S.  $39^{\circ}$  W. *Ava-talung-tangdip* is another more dominating group. To the west is Mount *Nindu*. *Namla-gompa* is seen on its cliff to the N.  $69^{\circ}$  W. To the N.  $50^{\circ}$  W. is the low and open country showing the situation of the valley of the great *Tsangpo*. About N.  $35^{\circ}$  W. is *Tuksum*.

On *June 28th*, we travelled 12 km. to the N. W. and N. N. E. passing *Namla-gompa* and camping on the right or southern bank of the Upper *Brahmaputra* or *Tsangpo*. Here *Camp CLXXXVIII* has an altitude of 4,583 m., or 25 m. lower than *Nagor*, the rate being 1:480. Some photos from *Namla-gompa* are to be found on p. 322, Vol. II.

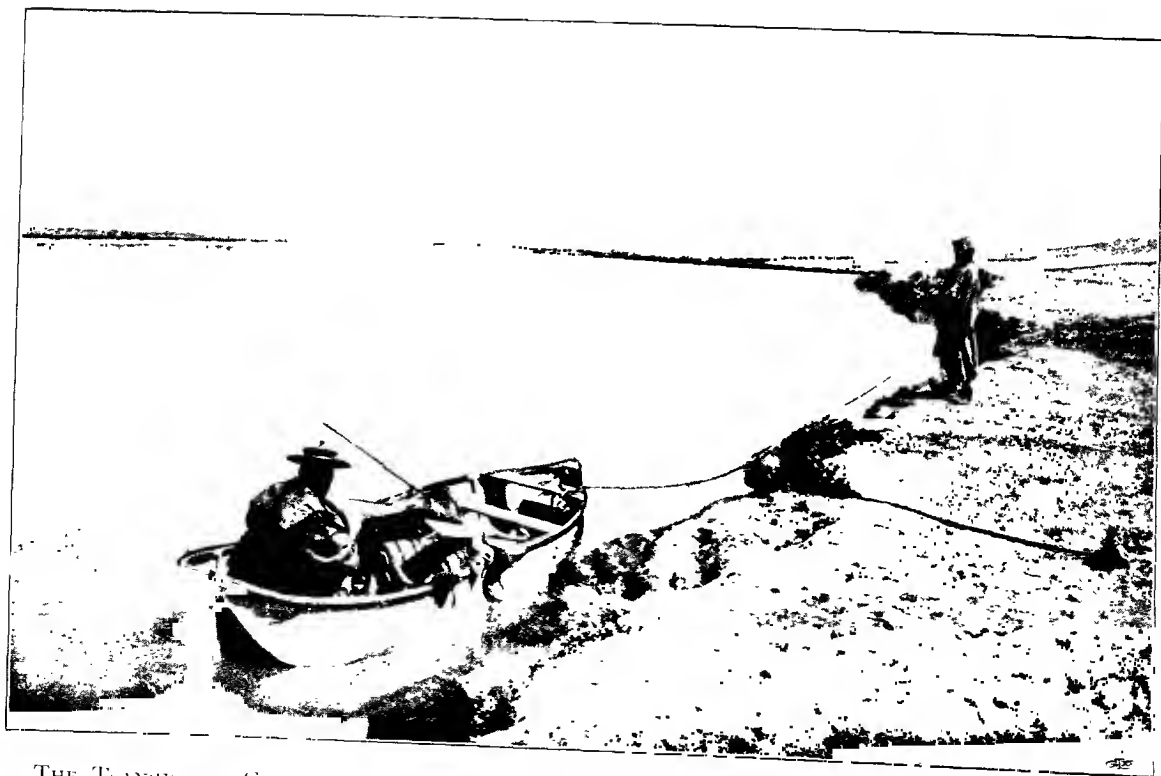


THE TSANGPO BETWEEN NAMLA AND DONGBO (CAMPS 188 AND 189).  
LOOKING S 25° E.





THE TSANGPO AT CAMP 101. LOOKING DOWN THE RIVER TO THE S. E.



THE TSANGPO AT CAMP 191. LOOKING UP THE RIVER TO THE S. W. (A LAMA IN MY BOAT).





The next day's journey consists simply in a crossing of the river to the N. N. E. *Camp CLXXXIX, Dongbo*, had an observed altitude of 4,598 m. The distance is not quite 5 km., and the rise of 15 m. is due to the camp being placed on a little sandy hill. Pan. 247A and B, Tab. 45, is taken from there. To the S. 28° E. and S. W. some comparatively high *Himalaya* peaks are in sight. *Teriyong* is a peak in the neighbourhood to the north. To the east the name *Tirok* appears again.

On *June 30th*, we marched 22.7 km. N. W. to *Camp CXc, Tuksum*, at an altitude of 4,596 m., or a rise of 13 m. from the river at *Camp CLXXXIX* which must be regarded as practically the same altitude as *Camp CLXXXVIII*, or 4,583 m. The rate is, therefore, 1:1746. The panorama from *Tuksum*, 248A and B, Tab. 45, goes round the whole horizon representing the northern mountains at a short distance, the southern far away. Amongst the latter are several peaks covered with eternal snow, for instance, the massif *Kakju*, or *Kakjy*, the highest part of which is at S. 60° W. To the N. 71° W. the country is low and open, being the broad valley of the *Tsangpo*.

On *July 2nd*, we had a march of 9.6 km. W. N. W. to *Camp CXCI*, 4,608 m. high, or a rise of 12 m., at a rate of 1:800. Pan. 250A and B, Tab. 45, gives an idea of the landscape around the river at this place. At p. 326, Vol. II, there are two photos from this camp.

The next day, *July 3rd*, we had 15.7 km. W. S. W. on nearly level ground to *Camp CXcII, Yüri*, with an altitude of 4,615 m., a rise of 7 m. and a rate of 1:2243. Pan. 249A and B, Tab. 45, is drawn from *Yüri*, showing flat hills in the neighbourhood, and a few higher peaks at greater distance.

The road to the next camp, *Camp CXcIII, Nangi*, at an altitude of 4,627 m., goes over nearly level ground, the rise in 32.3 km. W. N. W. being only 12 m. or as 1:2692. Pan. 252A and B, Tab. 46, comes from *Nangi*. The surrounding mountains are rather low and flat, and the country to the N. W. very open.

On *July 5th*, we made 13.3 km. nearly north to *Camp CXcIV, Gyang-chu-kamar*, where the height is 4,661 m., or 34 m. above the previous camp, a rise of 1:391. Pan. 253A and B, Tab. 46, is taken from the new camp. To the S. 64° E. it shows Mount *Churi*, which was visible to the N. 58° E. on Pan. 252A, Tab. 46, from *Nangi*. To the south and S. W. it unrolls a perspective of more considerable mountains with pyramidal snowy peaks. To the N. W. the country is open as usual.

On *July 6th*, the beginning and the end of the march are nearly at the same altitude, for we started from 4,661 m. and camped at 4,657 m. The distance to *Camp CXcV, Chärok*, being 19.3 km., and the fall 4 m., the rate is 1:4825 or practically level. From the little threshold on the road, *Rubi-la*, 4,675 m. high, Pan. 251, Tab. 45, was sketched, showing, once more, Mount *Kakju* to the S. 27° W., the same that, on Pan. 248A, Tab. 45, was visible to the S. 60° W. The landscape represented

on Pan. 254A and B, Tab. 46, is drawn from *Chärok*. It unrolls only to the south considerable mountains, being probably the eastern continuation of the *Kubi-gangri Range*. To the S.  $63^{\circ}$  E., where the country is very low, the *Tsangpo* flows down. If *Chärok* is at 4,657 m., and *Camp CLXXXVIII* at 4,583 m., and the distance between the two camps 90 km., the difference of height, 74 m., would mean a rate of descent of the river of 1:1216. At *Camp CCI*, *Shapka*, 66 km. higher up, the altitude is 4,841 m., or 184 m. higher than at *Chärok*. Here the rate of descent is thus 1:359. The fall of the river along its long course does not form a regular parabola, but changes from one section to another.

On *July 7th*, we travelled 8.8 km. north and N. W. to *Camp CXCVI*, *Sham-sang*, at an altitude of 4,697 m., or 40 m. above the preceding camp, the rate being 1:220. The next day we had 6.7 km. W. N. W. rising only 5 m., or to 4,702 m., which was the altitude at *Umboo*, *Camp CXCVII*. The rate was thus only 1:1340. On *July 9th*, we travelled 14.8 km. west to *Camp CXCVIII*, *Tok-jonsung*, at an altitude of 4,732 m., or a rise of 30 m., and a rate of 1:493.

Pan. 255A and B, Tab. 46, drawn at the confluence of the *Maryum-chu* from *Maryum-la* and the *Chema-yundung* (or *yungdung*) River, is of a certain interest. It shows to the S.  $60^{\circ}$  W. a distant mountain called *Kubri*. This cannot be any other than *Kubi-gangri*, though I have heard the name given as *Kubri* when I heard of it for the first time, and wrote it down as *Kubri*. In this form it appears on the panorama. To the N.  $55^{\circ}$  W. is the valley by which the *Maryum-chu* comes down. To the N. E. and E. N. E. are mountains and ridges obviously belonging to the *Pedang Range* of *Transhimalaya*. From a terrace close to *Camp CXCVIII*, Pan. 257, Tab. 47, was drawn. On this sketch we find the first reliable perspective of the mighty mountains amongst which the source, or sources, of the *Brahmaputra* are situated. To the S.  $49^{\circ}$  W. is a peak that may be the *Absi*. To the S.  $68^{\circ}$  W. is a fine view of the *Chema-yundung-pu*, and to the S.  $86^{\circ}$  W. are other peaks belonging to the *Chema-yundung*. To the north and N. E. is a sea of mountains.

On *July 10th*, the road is directed to the W. S. W. and S. W. to *Shäryak*, *Camp CXCIX*, at an altitude of 4,874 m., or a rise of 142 m., and a rate of 1:88.

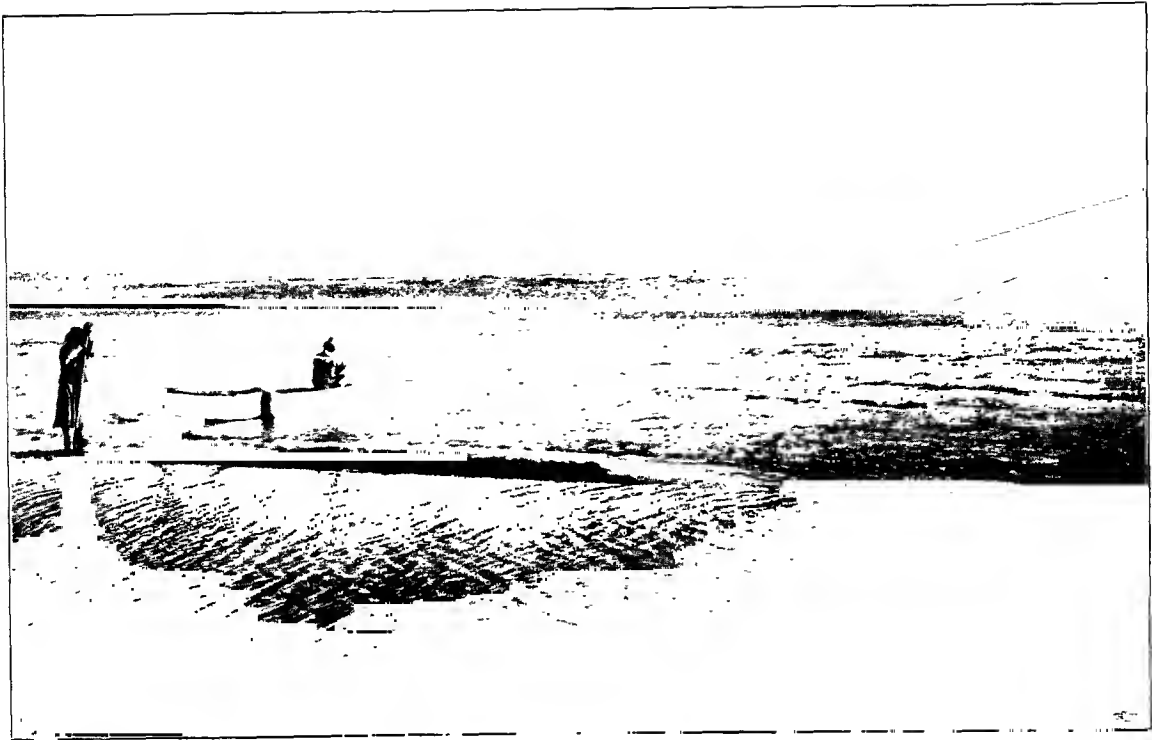
On *July 11th*, we approach the *Kubi-gangri* in a south-westerly direction, marching 6.5 km. to the pass *Tso-niti-kargang*, 5,138 m. high, or 264 m. above the last camp, being a rise of 1:247. The descent to *Camp CC*, *Hlayak*, at 4,861 m., is 5.5 km. in length and 277 m. in height, being a fall of 1:20.

From the pass *Tso-niti-kargang* I had the first opportunity to make a sketch of all the peaks of the *Kubi-gangri*, Pan. 258A and B, Tab. 47. To the S.  $30^{\circ}$  E. and S.  $1^{\circ}$  E. are two peaks, *Lung-yung* and *Kargam-nakbo*, belonging to the same *Himalaya Range* as the *Kubi*. To the S.  $16^{\circ}$  W. is *Ngomo-dingding*, then the *Absi* and its glacier, the *Mukchung-jungu*, *Mukchung-tseun*, *Langta-chen*, *Gaveting*,

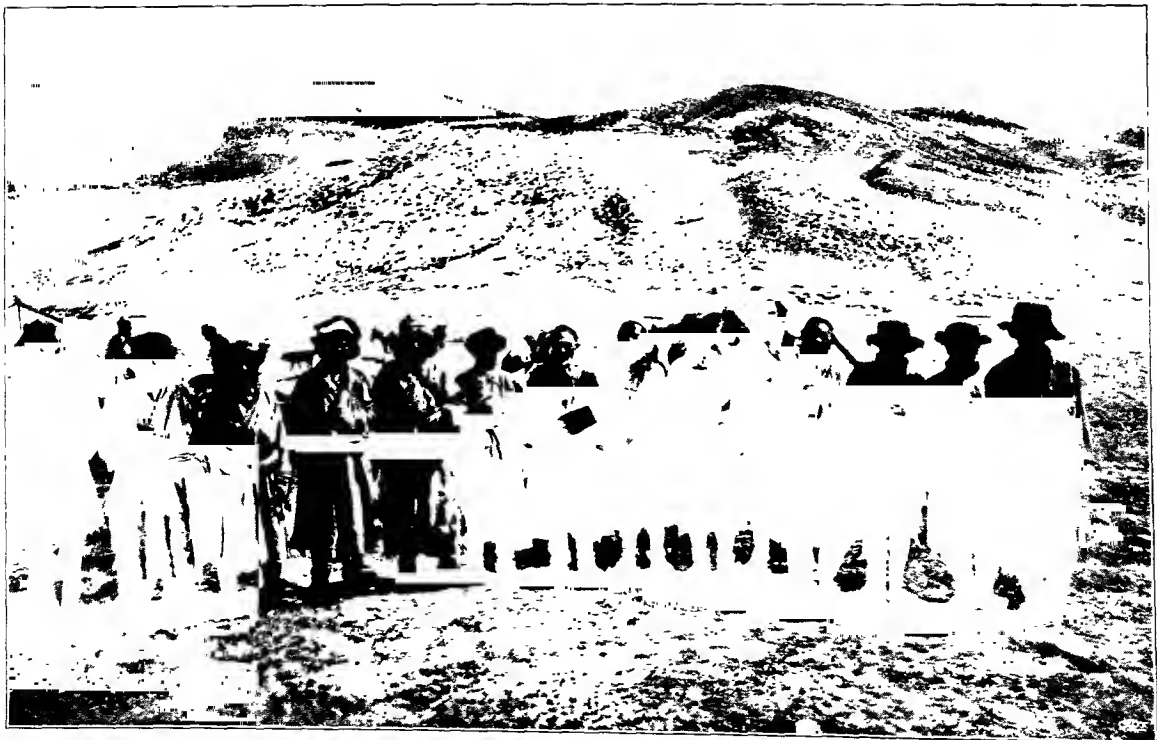


THE UPPER TSANGPO BELOW THE CONFLUENCE OF THE  
KUBI-TSANGPO AND THE CHEMA-YUNDUNG.





MEASURING THE VOLUME IN ONE OF THE UPPERMOST BRANCHES OF THE TSANGPO JUST BELOW THE CONFLUENCE OF THE KUBI-TSANGPO AND THE CHEMA-YUNDUNG.



SOME OF MY LADAKI SERVANTS RETURNING HOME FROM TOKCHEN.



*Dongdong*, *Chema-yundung-pu* and *Chetea*, which is a mountainous region north of *Chema-yundung-pu*. From *Camp CC* some of the same mountains were drawn when covered with clouds, as shown on Pan. 260, Tab. 48. Here a new name, *Mukchung-simo*, makes its appearance.

On *July 12th*, we travelled S. W. 17.6 km. to *Camp CCI* at *Shapka*, where the altitude is 4,841 m., or 20 m. lower than *Hlayak* which is situated on the slope of the left side of the *Kubi-tsangpo*. From *Shapka*, Pan. 259, Tab. 47, is taken. It shows the valley of the *Kubi-tsangpo* to the N. E., and to the east and E. S. E. the northern ramifications from the *Kubi-gangri*. The little peak to the S. 52° E. is the same as the peak farthest to the left on Pan. 261, Tab. 48, which is in immediate connection with Pan. 259, though the continuity has been interrupted in the Atlas of Panoramas. On Pan. 261 it is easy to recognize the peaks we already know from the view from *Tso-niti-kargang*, though now the perspective and the angles have changed.

The next day we made an excursion 8.8 km. west to the snout of the two glaciers which I have called *Langta-chen* (from one of the peaks in its upper reaches) and *Brahmaputra* Glacier, as it is the highest feeder of the *Kubi-tsangpo* which is the main source of the *Brahmaputra*. The two glaciers join and have a common snout. In front of this is a moraine on the slope of which Pan. 256, Tab. 47, was sketched, showing again the imposing perspective of the ring of high peaks surrounding to the south the sources of the *Kubi-tsangpo*, and all together called *Kubi-gangri*.

On *July 14th*, we climbed the moraine heaps and hills west of *Camp CCI* 3.7 km. to a point 5,310 m. high. The rise is 469 m. and the rate 1:7.9. From this point I sketched the complete panorama 262A and B, Tab. 48, which gives a new aspect to the peaks of the *Kubi-gangri*. This panorama took some three hours to draw. Immediately after it was completed I made a panorama in a series of photographic plates connected uninterruptedly with one another. It is to be found opposite p. 262 of Vol. II, and should be carefully compared with the pencil-drawing as such a comparison gives an idea of the degree of exactitude at which I was able to arrive in the panorama-sketching. These two panoramas have been scientifically compared and discussed by Professor Karl D. P. Rosén in *Ymer*, 1918, as quoted above.

From the point 5,310 m. high., we had 10.2 km. N. E. to *Camp CCII*, *Dongdong*, 4,844 m. high, a fall of 466 m. and a rate of 1:22.

On *July 15th*, we continued N. E. The first 9.6 km. took us to *Kargang-la* 5,182 m. high, a rise of 338 m. and a rate of 1:28. From the pass we had 4.8 km. to *Camp CCIII*, *Dara-sumkor*, 4,931 m. high, a descent of 251 m. and a rate of 1:19. Pan. 266A and B, Tab. 49, was drawn from *Kargang-la*. It shows the *Dongdong-pu* and *Chema-yundung-pu* both snow-mountains with glaciers contributing to



feed the *Kubi-tsangpo*. *Maryum-la* was pointed out to the N. 22° E. though it probably is situated more to the west.

On *July 16th*, our march goes N. N. W. After 5.5 km. we were at the pass *Tugri-la*, 5,270 m. high, or 339 m. above *Camp CCIII*, the rate being 1:16.2. From the pass we had 10.8 km. to *Camp CCIV* at 4,870 m., a descent of 400 m., or as 1:27. From *Tugri-la* the panorama 265A and B, Tab. 49, was sketched. To the S. 65° W. we now have a new aspect of *Chema-yundung-pu*. The panorama gives an excellent idea of the relief of the country, though several of the names given did not appear any more. *Tamlang-ding* is obviously the pass which later on was called *Tamlung-la*. *Dugri*, or *Tugri-kunglung*, is the valley of the brook going N. N. W. from the pass. To the N. 58° E. is a lake, very small, and situated between hills. To the right of it we get a glimpse of the valley of *Chema-yundung*. To the S. E. and S. S. E. are comparatively high mountains in connection with the *Kubi-gangri*. Pan. 268A and B, Tab. 49, is taken from *Camp CCIV*, *Buk-gyäya-rap*. Here we again behold some of the peaks belonging to the *Kubi-gangri*. The rest of the panorama, which embraces the whole horizon, does not contain any considerable peaks.

The next day we made only 8.5 km. N. N. W. to *Camp CCV* at *Tünchung*, where the altitude is 4,987 m. The ascent is thus 117 m. or a rate of 1:73.

On *July 18th*, the march is W. S. W. The first 12.7 km. take us to *Marnyak-la* with an altitude of 5,302 m., the ascent being 315 m. and the rate 1:40.3. On the west side we had 7 km. and a descent of 266 m. to *Camp CCVI*, *Loang-goa*, at an altitude of 5,036 m., the rate of fall thus being 1:26.

Pan. 263, Tab. 48, is drawn from *Marnyak-la* and gives an interesting view of some of the high mountains to the south and S. W. A part of the snow and ice-covered mountain group of *Chema-yundung* is visible to the S. 1° E. To the S. 21° W. is *Memo-gangri*, a name which also is given to *Gurla-mandata* and may correctly indicate that the two mountains belong to one and the same range. S. 31° W. more distant peaks are visible. To the S. 44° W. is the group *Tsangli-gangri*, and about S. 60° W. *Angsi-dongdong* which probably is the mountain from where the *Angsi-chu* comes down, in the region of which, and north of which, the water-parting between the *Brahmaputra* and the *Indus* is situated.

To the north from the same pass Pan. 264, Tab. 48, was sketched giving the impression of a stormy sea. The guides gave several names to the peaks visible from the pass to the north, N. E. and E. N. E.

From *Camp CCVI*, Pan. 277A and B, Tab. 51, was drawn. Only the nearest hills with rounded and weathered forms were visible from here.

The road of *July 19th*, continues W. N. W. The first 17.6 km. lead to the pass *Tamlung-la* 5,279 m. high, a rise of 243 m. at a rate of 1:72.4. On the

western side it is 5.2 km. to *Camp CCVII, Chian-karpo*, 5,133 m. high, or a descent of 146 m. and a rate of 1:36. Pan. 269, Tab. 49, was sketched on *Tamlung-la*. It shows several of the high peaks to the S. E., south and S. W. more or less hidden by clouds. To the S. S. W. is *Ganglung-gangri*, interesting as being the place from which the *Tage-tsangpo*, or uppermost *Satlej*, has its source. To the west, a part of *Gurla-mandata* is in sight, and to the N. 77° W. is our road of the next day.

The first day's march within the drainage area of the *Indus* took us from *Camp CCVII* to *Camp CCVIII, Tag-ramoche*, 15.5 km. W. N. W., in the valley of the Upper *Tage-tsangpo*. The fall was 185 m. and the rate 1:84. Pan. 275A and B, Tab. 50, is drawn from the last-mentioned camp. It unrolls a series of high peaks to the south, *Memo-gangri*, *Ganglung* (or, better, *Kang-lung*), *Hlalung*, *Dunchum-pu*, *Panglung*, *Panglung-chonga*, and *Dugri*. The hill to the left or southern side of the valley of *Tage-tsangpo* is also called *Dugri*. *Tage-bup* with the road of our next day is the name of the valley of the last-mentioned river. To the N. W. is *Chumik-ri*, »the mountain of the spring», for at its base a spring crops up.

On *July 21st*, we travelled 16 km. west to *Camp CCIX, Tso-nyak*, at an altitude of 4,840 m. being a fall of 108 m. and at a rate of 1:148.

From a point near the above-mentioned spring Pan. 267, Tab. 49, represents the appearance of the mountains at the left side of the *Tage-tsangpo*. Pan. 270, Tab. 50, is a narrow passage in the same valley with a part of the *Gurla-mandata* visible to the S. 71° W. Pan. 271A and B, Tab. 50, is taken from the little secondary threshold, *Holum-babsa*. It is interesting in so far as it shows quite clearly for the first time the *Gurla-mandata*, the first glimpse of the *Kailas* and of the hills behind which the *Sacred Lake* is located. *Tagdung*, *Sinchen*, and *Sinchung* are mountains to the south. The highest peak of *Gurla-mandata* is visible to the S. 73° W. To the N. 83° W. not far away is a little conical hill. To the N. 71° W. the guides show the nearest point of the *Manasarovar*. To the N. 37° W. is the *Kang-rinpoche* or »*Sacred Ice-Mount*», i. e., *Kailas*. N. 25° W. is Mount *Pachen* and farther east some less important peaks.

On *July 22nd*, the march goes north 9.3 km. to *Camp CCX, Namarden*, at an altitude of 4,720 m., or 120 m. below the previous camp, the descent being at a rate of 1:77. Pan. 272, Tab. 50, is drawn from the point where we crossed the *Tage-tsangpo*, and gives a perspective of the same valley by which we had travelled. Pan. 273, Tab. 50, shows a part of *Gurla-mandata* with some clouds. Pan. 274, Tab. 50, is taken from a terrace just south of *Namarden* and shows to the N. N. E. some other lacustrine terraces. Pan. 278A and B, Tab. 51, shows to the S. 57° W. the *Gurla-mandata*, to the N. N. W. the mountains to the east of *Manasarovar*, to the N. E.

some of the lacustrine terraces, and to the E. N. E. and east Mount *Durtse* and other hills.

On *July 23rd*, our march goes north and N. N. W., first 9.8 km to the secondary pass *Karpo-la*, 4,888 m. high, or 168 m. above the last camp, being a rise of 1:58. From the pass we had 7.5 km. to *Camp CCXI, Tokchen*, at an altitude of 4,635 m., or a descent of 253 m. being at a rate of 1:29. To the S. E., south and S. W. from *Karpo-la* some of the peaks which we already know are again visible, amongst them *Gurla-mandata* to the S. 31° W.

On *July 26th*, we accomplished the march of 9.2 km. across the hills to the S. W., travelling up and down, and camping at *Camp CCXII* with a height of 4,602 m. on the shore of the *Manasarovar*. About halfway the first sketch of the *Manasarovar* was made, from a hill-slope, Pan. 282A and B, Tab. 52. There we see, to the S. W. at least, the base of the *Gurla-mandata*, the higher regions of the mountain being hidden in clouds. To the W. S. W., west and W. N. W. we see the contour line of the narrow neck of land between the *Manasarovar* and the *Rakas-tal*. N. 42° W. there is just a little glimpse of the *Kailas*. To the N. 21° W. is Mount *Pundi*. To the N. 4° W. is the mouth of the valley *Pachung*, and N. 7° E. the mouth of the valley *Pachen*.<sup>1</sup>

At *Camp CCXII*, on the very shore of the *Sacred Lake*, Pan. 279A and B, Tab. 51, was drawn. It gives a very good idea of the *Manasarovar* as seen from the eastern shore, and includes all the famous mountains. To the S. 37° W. the *Gurla-mandata* is visible, though somewhat disturbed by clouds. To the S. 59° W. are some of the *Purang* Mountains on the other side of uppermost *Karnali*. Then again to the W. S. W., west and W. N. W. comes the contour of the neck of land between the two lakes, being nearly the same as on Pan. 282A, Tab. 52, though the shadows of clouds make an apparent difference, which, however, of course does not influence the contour-line. To the N. 70° W. is *Chiu-gompa* with the outlet of the lake. To the N. 37° W. is Mount *Kailas*, to N. 11° W. *Pundi-ri*, to the north the valley of *Pachung*, the *Pachen* being to the right of it.<sup>2</sup>

From *Camp CCXVIII* on the western shore and just south of *Gosul-gompa*, Pan. 280, Tab. 51, was drawn, showing the contour-line of the mountains on the eastern side of the lake. The little panorama, 281, Tab. 51, from the same place, is a view of the *Gurla-mandata* to the S. 9° W.

From *Camp CCXIV* situated between *Gosul-gompa* and *Chiu-gompa*, or rather from a hill above the camp, Pan. 283, Tab. 52, was drawn, showing the profile across the neck of land between the two lakes. From the same point Pan. 284A

<sup>1</sup> On Pan. 282B the two names have to change place.

<sup>2</sup> Here again the two names have changed place.

and B, Tab. 52, is sketched, beginning from the north and continuing over east to the south. The *Kailas* is hidden by clouds, and so is *Pundi*, at least partly. To the right or east of the latter are the two easily recognizable valleys, *Pachung* and *Pachen*. To about N. 80° E. is the valley of the *Samo-tsangpo*, and S. 72° E. that of the *Tage-tsangpo*. To the S. S. W. only a part of the slopes of the *Gurla-mandata* is seen.

From *Camp CCXV* we have the view shown by Pan. 285, Tab. 52, with *Kailas* to the N. 26° W., the *Pachung* and *Pachen* to the N. 17° E. and N. 27° E., and the valley *Namarding* to the S. 88° E. Pan. 286, Tab. 52, shows again the contour-line of the neck of land between the two lakes, though under other angles. To about N. 55° W., is the low tract where the water goes out occasionally to the *Rakas-tal*.

From *Camp CCXVI* the coloured panorama in Vol. II, p. 153 was painted just after sunset. Pan. 290A and B, Tab. 53, also dates from that place. It begins with the southern shore-line of the lake and includes a sketch of the *Tugu-gompa* with *chortens* and tents and houses of the lamas. To the south are the hills sloping down to the lake from *Gurla-mandata*. One of the culminating peaks of this mountain is visible to the S. 47° W. To the N. 13° W. the *Kailas* rises above everything else. To the N. N. E. are the *Pundi*, *Pachung*, and *Pachen* as usual.

Pan. 292A and B, Tab. 53, gives a good view of the mountains round the *Manasarovar* so far as they are in sight from the little monastery of *Gosul-gompa*, *Camp CCXVII*. The *Kailas* is hidden by a part of the temple. *Lungnak* is a mountainous region west of *Pundi*. To the east of the latter we again recognize the *Pachung* and *Pachen*. To the N. 64° E. is a peak *Dongtse*, and to the right of it the *Samo-tsangpo* comes down. To the S. 80° E., is the valley of *Tage-tsangpo*. To the S. 37° E. is the place of *Tugu-gompa*, though the monastery itself cannot be seen on account of the great distance and the vibrations of the air. To the S. 1° W., and S. 11° W. are two of the picturesque peaks of the *Gurla-mandata*.

Halfway between *Camp CCXVI* and *Camp CCXVIII* where the brook *Namreldi* or *Namreling* comes down from *Gurla-mandata*, Pan. 288, Tab. 53, was drawn, giving again a view of the *Gurla* so far as it is visible from there. A little farther west a new panorama, 293A and B, Tab. 54, was drawn from *Camp CCXVIII*, *Yese*. Here the valley of *Namreling* appears under different angles, but should be compared with its perspective on Pan. 288. Everything is recognizable, the two sketches give an idea of the forms of the mountains. On the last-mentioned panorama we see to the S. W. the slopes of the *Gurla*. Then follow to the right the low mountains on the neck between the lakes. To the N. 10° W. is *Kailas*. *Gosul-gompa* is also marked, though it is doubtful on which of the sloping hills it is situated as it was too far for my eyes. *Pundi*, *Pachung*, and *Pachen* are as usual. To the S. 78° E. is *Tugu-gompa*.

On *August 12th*, Pan. 287, Tab. 52, was sketched from a point 6.5 km. south of *Camp CCXVIII* on the slope of *Gurla-mandata*. On this sketch we get the first view of *Rakas-tal*, and see both lakes with the neck of land between them. As usual *Kailas* commands the northern horizon. Pan. 291, Tab. 53, is drawn from a pass west of the *Namreldi* valley.

From *Camp CCXIX* at *Chiu-gompa*, Pan. 295, Tab. 54, shows the monastery on its hill. Pan. 294, Tab. 54, is a sketch from a point a short distance west of the camp and shows the bridge across the *Ngangga*, or brook, which in some years carries the superfluous water of the *Manasarovar* into the *Rakas-tal*. Pan. 297, Tab. 54, shows the waterfilled part of the channel above the bridge. From a hill above, I drew Pan. 299A and B, Tab. 55. It is instructive for it shows nearly the whole course of the *Ngangga*. To the far left we see a part of the *Manasarovar*, and, at the base of the hill, the *Ngangga* rivulet and the mountains bounding it to the south. To the W. S. W. we can follow the winding course of the *Ngangga* down to the *Rakas-tal*, the northern part of which is visible to the N.  $79^{\circ}$  W. This western part of the channel was dry at my visit as I have explained in Vol. II. To the N.  $15^{\circ}$  W. is *Kailas* in clouds, and to the N.  $55^{\circ}$  E. the *Pundi*. Pan. 298, Tab. 54, may be regarded as a continuation of the one just described, though it is taken from another point quite near the first. The *Pundi* appears again at the left end, and the ridge of *Chergip-gompa*. Opposite, to the S.  $77\frac{1}{2}^{\circ}$  E., is *Camp CCXII*, the first on the lake.

Pan. 300A and B, Tab. 55, from *Camp CCXX* gives a view of the *Kailas* to the N.  $39^{\circ}$  W., the *Pundi* to the north, the *Pachung* and *Pachen* to the N. E. A part of the lagoon *Ting-tso* is also in sight. Pan. 302, Tab. 55 is drawn from a point between the *Pachung* and *Pachen*, giving a perspective of the *Gurla-mandata* to the S.  $23^{\circ}$  W. and S.  $28^{\circ}$  W. From *Pundi-gompa* we observe Pan. 303, Tab. 56, with a view of *Gurla-mandata*, and, in the foreground, the lagoon *Kurgyal-tso*. From *Chergip-gompa* between *Camp CCXXII* and *Camp CCXIX*, the *Gurla* is visible under a somewhat different aspect. Cp. Pan. 304, Tab. 56.

Turning our attention to the *Rakas-tal*, we have first to consider Pan. 296A and B, Tab. 54, which is taken from a pass of 4,887 m. on the mid point of the neck of land between the two lakes, thus being 285 m. above the surface of the *Manasarovar* and 298 m. above the surface of the *Rakas-tal*. The view from this point is magnificent. It is impossible, it is true, to get an adequate idea of the outlines of the lake from one single reconnoitring like this, but this much at once becomes clear, namely, that the *Rakas-tal* is still more framed with mountains than the *Manasarovar*, that at least five narrow promontories are directed to the north from its southern shore, that it has some three islands in its southern part, and that it becomes narrower to the north.

To the S. E. a little part of the *Manasarovar* is in sight at the base of the hills which rise rather steeply towards the culmination points of the *Gurla-mandata*, the highest peaks of which are seen to the S.  $7^{\circ}$  E. and S.  $5^{\circ}$  W. To the S. W. far away are again the crests of the mountains in *Purang*. To the S.  $75^{\circ}$  W. is the island of *Lache-to* which I visited later on. S.  $80^{\circ}$  W. and S.  $88^{\circ}$  W. are two islands, both, or at least one, called *Dopserma*. To the N.  $64^{\circ}$  W. a long, narrow and low promontory projects into the lake in the same direction as the pyramidal peak *Tsepge-ri*. The northern part of the lake is hidden by the hills of the neck of land between the lakes.

A few hundred metres north of *Camp CCXXIV* at the N. W. shore of the lake I sketched Pan. 301A, B and C, Tab. 55. To the west and W. N. W. it shows considerable hills on the west shore of the lake, and to about the N.  $18^{\circ}$  W. the place at which in older times the *Satlej* left the *Rakas-tal*. To the N.  $13^{\circ}$  E. is the *Kailas* partly hidden by clouds. To the N.  $77^{\circ}$  E. Mount *Pundi* is still in sight, and S.  $75^{\circ}$  E. is the low passage where the *Ngangga* takes its course. The mountain rising in the same direction is situated at the eastern shore of the *Manasarovar*, and has already been found on Pan. 298, Tab. 54, to the S.  $77\frac{1}{2}^{\circ}$  E. from *Chiu-gompa*. A little farther to the right at about the S.  $60^{\circ}$  E. the mountains on the neck of land between the lakes conceal the eastern shore of the *Manasarovar*. S.  $17^{\circ}$  E. marks the place where the *Rakas-tal* is narrow and resembles the neck of a bottle. The *Gurla-mandata* is hidden by clouds, only its western slopes being seen to the S.  $4^{\circ}$  E. To the S.  $52^{\circ}$  E. *Camp CCXXV* is entered. I could take its bearings from the smoke of the campfire of my men preparing the camp during my trip across the lake.

Pan. 309, Tab. 56, is taken from *Camp CCXXIV*. Its object is chiefly to show the beach-lines of the *Rakas-tal*, proving that the lake, in the present period, is gradually sinking, which again is the reason of the cutting off of the *Satlej*.

From a cape 4.5 km. S.  $10^{\circ}$  W. of *Camp CCXXV* on the eastern shore of the narrow part of the *Rakas-tal*, Pan. 305, Tab. 56, was drawn. To the S.  $30^{\circ}$  W. it shows the southern cape of the peninsula north of *Dopserma*. To the S.  $60^{\circ}$  W. is the point of the above-mentioned promontory from the western shore.

Pan. 306, Tab. 56, is taken from *Camp CCXXVI*. It is a view of the southern part of the lake, but promontories and islands melt together with the mountains behind. To the N.  $55^{\circ}$  W. is a considerable mountain on the western shore, and to the N.  $32^{\circ}$  W. is the entrance to the narrow passage of the lake enclosed to the east by the neck of land between the lakes.

On Pan. 307A and B, Tab. 56, from *Camp CCXXVII*, we get a view of the mountains on the western shore, and those to the north of the entrance to the narrow passage. To the N.  $4^{\circ}$  E. is the *Kailas* and between N.  $14^{\circ}$  E. and N.  $29^{\circ}$  E. the

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A few hundred metres north of *Camp CCXXIV* at the N. W. shore of the lake I sketched Pan. 301A, B and C, Tab. 55. To the west and W. N. W. it shows considerable hills on the west shore of the lake, and to about the N.  $18^{\circ}$  W. the place at which in older times the *Satlej* left the *Rakas-tal*. To the N.  $13^{\circ}$  E. is the *Kailas* partly hidden by clouds. To the N.  $77^{\circ}$  E. Mount *Pundi* is still in sight, and S.  $75^{\circ}$  E. is the low passage where the *Ngangga* takes its course. The mountain rising in the same direction is situated at the eastern shore of the *Manasarovar*, and has already been found on Pan. 298, Tab. 54, to the S.  $77\frac{1}{2}^{\circ}$  E. from *Chiu-gompa*. A little farther to the right at about the S.  $60^{\circ}$  E. the mountains on the neck of land between the lakes conceal the eastern shore of the *Manasarovar*. S.  $17^{\circ}$  E. marks the place where the *Rakas-tal* is narrow and resembles the neck of a bottle. The *Gurla-mandata* is hidden by clouds, only its western slopes being seen to the S.  $4^{\circ}$  E. To the S.  $52^{\circ}$  E. *Camp CCXXV* is entered. I could take its bearings from the smoke of the campfire of my men preparing the camp during my trip across the lake.

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Pan. 306, Tab. 56, is taken from *Camp CCXXVI*. It is a view of the southern part of the lake, but promontories and islands melt together with the mountains behind. To the N.  $55^{\circ}$  W. is a considerable mountain on the western shore, and to the N.  $32^{\circ}$  W. is the entrance to the narrow passage of the lake enclosed to the east by the neck of land between the lakes.

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island *Lache-to*. To the N.  $44^{\circ}$  E. is the *Pundi*. A sketch of the *Gurla-mandata* was drawn from the S. E. shore of the island *Lache-to*, Pan. 312, Tab. 57.

Pan. 308, Tab. 56, is drawn from a point between *Camp CCXXVII* and *Camp CCXXVIII*, showing the same lake in another perspective. From N.  $47^{\circ}$  W. to N.  $15^{\circ}$  W. the island *Dopserma* seems to be situated, though it was always difficult to determine its outlines from those of the hills behind. Here the *Kailas* rises to the N.  $6^{\circ}$  E., just in the prolongation of the »neck of the bottle». *Lache-to* is visible to the N.  $45^{\circ}$ — $54^{\circ}$  E. and N.  $59^{\circ}$  E. is the projecting cape south of it. Pan. 313, Tab. 57, is a little sketch to the E. S. E. from *Camp CCXXVIII*.

According to my observations, *Khaleb*, *Camp CCXXX*, has an absolute height of 4,629 m., and is 14.2 km. from the northern shore of the *Rakas-tal*. The rise is, therefore, 40 m. or as 1:355, which proves how very flat the plain is north of the lake. *Parka* is at an altitude of 4,601 m. and 5.7 km. from the lake. The rise is here 12 m. or as 1:475.

From *Khaleb*, Pan. 315A and B, Tab. 57, was drawn, showing the range of which *Kailas* is the culminating point. The *Sacred Mount* is seen to the N.  $34^{\circ}$  E., and the sketch should be compared with the frontispiece photograph of Vol. I, p. XVIII. To the S.  $79^{\circ}$  E. is the *Pundi*, which indeed seems to belong to the same range as the *Kailas*. S.  $17^{\circ}$  E. and S.  $11^{\circ}$  E. are the two highest peaks of the *Gurla-mandata*. Nothing is seen of the lake.

Finally I have only to call attention to the two panoramas, 310 and 311, Tab. 56, the first being a view down and south-westwards in the valley of the old *Sattlej*, and the second a view to the east in the old bed of the river. Both are taken from the termination of the excursion from *Khaleb*, *September 6th*, 1907.

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## CHAPTER XXX.

### THE PILGRIMS' ROAD AROUND THE KAILAS.

In this chapter I will insert a description of my journey on *September 3rd, 4th and 5th, 1907*, around the *Kailas*.<sup>1</sup> The first day we travelled N. E., N. N. E. and E. N. E. for 20.1 km. to the monastery of *Diri-pu-gompa* or *Camp CCXXXI*, being situated at an altitude of 5,091 m. The ascent is therefore 462 m. or 1:43.5. The first kilometers from *Khaleb* take us over gradually rising ground of gravel, sand and dust and covered with some tussock-grass. There are no old terraces or beach-lines to be seen, and such could not be expected around a lake which for so long a period has possessed an outlet.

Before entering the mountains we have to cross a belt of moraines consisting of gravel and blocks in great ridges and heaps, as a rule, stretching N. W.—S. E. From the tops of these old moraine heaps, the northern part of the *Rakas-tal* is again in sight; in the valleys between them everything around us is hidden. On the top of every large block there is a conical heap of small stones piled up by pilgrims. Such is the case the whole way along the road of pilgrimage around the *Sacred Mount*. Finally, the moraines become lower and cease altogether just before the entrance into the valley of the *Hlachu* brook, where the ground is soft and grass-covered, though in the very mouth some blocks are still laying about. Here the altitude is 4,700 m. The moraines outside the mouth of the valley betray a much more developed glaciation of the *Kailas* and its range in glacial and post-glacial time. Since then the ice-covering of the mountains has retreated gradually to the insignificant areas where ice is still existing, *i. e.* in the highest regions of the *Kailas Peak* and on the ridge east of it.

The valley, or rather the brook, is here called *Dunglung-chu* or *Dunglung-che* by the Tibetans, though it proved difficult to find out a reliable name known

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<sup>1</sup> The march up to *Diri-pu-gompa* is shortly described in Vol. II, p. 211, in connection with the description of the journey to the source of the *Indus*. Here I give a more complete narrative of the whole *kore* or pilgrims' wandering round the mount, illustrated by the panoramas taken on the march.

by everybody. Some pilgrims call it simply the *Nyandi* valley from the monastery a little higher up.

Living rock is difficult to reach, as mighty screes of gravel are situated along the base of the mountains nearly everywhere. On the left or eastern side of the brook, where the pilgrims' road from *Tarchen* goes, there is a small cubic house and several *manis*, and a little higher up some *chortens*. The ground is again gravelly, and blocks are numerous. Pan. 316, Tab. 57, is a view of the *Kailas* from a point a short distance above the mouth of the valley. It shows the very steep, sometimes nearly perpendicular, mountains of green and brownish sandstone and conglomerate. The landscape becomes more and more wild and picturesque the higher up we ascend. Stratification and erosion have worked out extraordinary formations resembling walls, fortresses and towers.

On the right or western side of the valley, there are again gigantic blocks, and series of *manis* and *chortens* again make their appearance on the left side. The green sandstone conglomerate falls 10° south.

Just below *Nyandi-gompa* and its hill, a bridge is built across the river and a party of pilgrims is just passing it from the left to the right bank of the river. The slope up to the *gompa* is very steep amongst gravel and blocks.

As I have not dealt with the monasteries in this work, I will say a few words of *Nyandi-gompa*. It is situated on a platform on the top of a scree at the base of the right or western conglomerate mountain side. The latter rises like a perpendicular wall above the *gompa* and is a very dangerous neighbourhood. Five years earlier, or 1902, a block measuring several cubic meters in size came down after a period of heavy rain and crushed the part of the temple called *tsam*, and was still laying in its centre. Nobody was killed, but a part of the monastery had to be rebuilt.

The name was *Nyandi* or *Nyändi-gompa*, and sometimes it was called *Nyanpo-ritsong*. At a considerable height above the monastery at the side of the mountain wall, was a *tsamkang* or eremite-dwelling, uninhabited in 1907. On the top of the mountain was a pole with streamers called *Nyandi-kong*. The *gompa* is subject to *Tarchen-labrang* at the southern foot of the *Kailas*, which is said to be under the oversight of *Tongsa Penlop* of *Buthan*. The same is said to be the case with the *Tsumtul-pu-gompa* and *Chergip-gompa*. Twenty lamas were said to belong to *Nyandi*, though only two of them were now there, the rest being spread in the region around for religious and other businesses. The two at home had never seen a European. Three years earlier four Europeans had passed the *Sacred Lake*, but had not visited the *gompa*, and two years earlier, one European had been to *Tarchen-gompa*, but had not wandered around the *Kailas*. The first-mentioned must of course have been Ryder's expedition, the latter Sherring.



THE GREEN SANDSTONE CONGLOMERATE AT NYANDI-GOMPA.



PILGRIMS ON THE ROAD TO DOLMA-LA.



Sherring gives a short description of the pilgrimage around the *Kailas*, but it does not appear from his narrative whether his communications are derived from his own observations or from native informants. Nor does his map say anything as to his own route, for it has all the trade routes marked in red. Concerning the road from *Tarchen* (or *Darchan*) and back to *Tarchen*, he says, the circuit is about 25 miles, *i. e.* 40.2 km. In reality it is 48.4. His description is interesting, as it was probably the single one existing before my journey. He says:<sup>1</sup> »The actual circuit round the holy mountain of Kailas . . . . occupies on an average three days, the distance being about twenty-five miles. The path is not good, walking is absolutely obligatory, and the track rises in one place to a very great height namely, to the Gauri-Kund, which is a lake that remains frozen at all times of the year, even in the hottest weather . . . . Ordinarily the first monastery visited is the one at Nendiphu (Nyandi-pu) . . . . The next monastery is at Dediphu (Diri-pu), and thence the road goes *viâ* the Gauri-Kund frozen lake to Zutulphu (or Jamdulphu) (*i. e.* Tsumtul-pu) . . . . Darchan is the spot where the circuit usually begins and ends.»

The description is fairly correct, though »the very great height» is not at *Gauri-kund*, but at the pass, *Dolma-la*, 4 km. west of the lake. A European who had made this journey would never have omitted to mention the pass which is by far the most striking experience on the whole way around the *Kailas*.

The four monasteries of *Kang-rinpoche* are *Nyandi*, *Diri-pu*, *Tsumtul* and *Gyangta*. In 1906, which was a *ta-lo* or »horse-year», *Nyandi-gompa* was visited by 5000 pilgrims, whereas in 1907 so far only about 500 had arrived, chiefly because of the small-pox in *Purang*. In 1906 some 500 Ladakis had arrived, in 1907 only about 40 or 50. These figures are, of course, very unreliable. Mongolian pilgrims never used to come. A curiosity in the *lakang* of the *gompa* is a pair of elephant's tusks called *langchen-sala-rapten* in Tibetan.

The view from the roof of the monastery is extremely picturesque. In the foreground the extraordinary characteristic lamaistic architecture with poles, streamers and rags, in the background the wild, steep conglomerate mountains and above all the peak of the *Sacred Kailas*. Some photos of this view are to be found opposite p. 210 of Vol. II.

The snowfall during the winter is said to be abundant. Sometimes it is even impossible to leave or reach the *gompa*. If necessary, the lamas then used to climb the crest of the mountains. In 1907 they had nearly no rain, though some years it rained heavily in the later part of the summer.

From *Nyandi-gompa* we went down again to the bridge, leaving it at our right and sticking to the right or western side of the river. The landscape is

<sup>1</sup> Western Tibet, p. 279 *et seq.*

surprising, magnificent. The western mountain wall is in two stories with a terrace platform between. Sometimes narrow, deep-cut side valleys open out to the main valley and have tremendous screes at their mouths. The left mountain wall is uninterrupted and has gigantic screes at its base. Sometimes vertical black bands are seen along the cliffs as if ink had been streaming there; they are the steep furrows of rainwater.

A little higher up, the rocks at the left or eastern side of the valley assume curious forms, reminding one of frozen cascades and waterfalls. Here the rock seems to be granite, for there is no stratification. The valley becomes narrow; blocks are abundant. At both sides jets of water from melting snow come down, the one to our right certainly 250 m. high; it is pulverized in the wind, forming a white veil, but the water again joins partly to form a jet reaching the bottom of the valley. All around the rocks are dark from the continuous spray.

A short distance N. E. of *Nyandi* the *Kailas* becomes hidden by nearer cliffs. Then it appears again like on the sketch, p. 212 (to the right in the upper row), Vol. II. The side valleys more and more assume the form of regular cañons. This is the most picturesque and fascinating region I have ever seen in Tibet. A natural stone-bridge is seen across a gorge with perpendicular sides, some 50 m. above its bottom. The road is very bad, covered as it is with gravel falling down from the mountains every year. In a new opening between the rocks, the *Kailas* is again visible, less imposing in this foreshortened perspective. Its vertical sides below the peak are striped black and white, rock and snow alternating.

Before reaching the junction with the tributaries *Chamo-lung-chu* or *Chamo-lungchen* coming in from the N. 70° W., we behold to the S. 50° W. a very considerable and picturesque snow-covered peak. In the background of the last-mentioned tributary, snow-covered mountains are also seen. They must be the same as those visible on several of my panoramas, for instance, the coloured one p. 153, Vol. II, and the coloured view in this chapter.

The next valley, from N. 5° W., is called *Dunglung* and the junction of the three valleys, *Dunglung-do*. Here two tents were pitched, and nomads were herding their flocks of sheep. Seen from this side, the *Kailas* resembles a tetrahedron on the top of a socle with very steep sides, *cp.* Pan. 319, Tab. 57. Pan. 317, Tab. 57, is taken some distance higher up the valley, always showing the tetrahedron; this form appears in a still higher degree from the S. 34° W., as on the frontispiece in Vol. I. Small bridges are built across the two tributaries. Yaks and sheep are grazing in the valley, which here is broader than before.

Then the peak again disappears for a while, hidden by wild rocks in front of it. There are masses of granite blocks, but no more cañons. The surfaces are

more rounded. In the opening between two prismatic mountain ridges, the *Kailas* again gives a brilliant spectacle to the south (Pan. 318, Tab. 57).<sup>1</sup>

A moment later we reach *Diri-pu-gompa* with a gigantic granite block in front of it, and the holy formula engraved on the surface of the latter (*cp.* drawing p. 152, Vol. II). Here, at *Camp CCXXXI*, the altitude is 5,091 m. The blocks laying about everywhere in the region consist of granite (quartz-biotite-diorite).

The next day's march on *September 4th*, took us 17.5 km. S. E., E. S. E., S. E. and finally S. S. W., around the northern and eastern parts of the *Kailas* massif. From *Diri-pu-gompa* we had only 1.3 km. S. E. to the pass *Dolma-la*, one of the highest we had to cross on the whole journey in *Tibet*, being 5,669 m. high or 578 m. above *Camp CCXXXI*. The rise is, therefore, if taken on a direct line, enormous, or as 1:2.25, which was the sharpest gradient I ever had. One had to ascend 1 m. for every 2¼ m. of road. As such a slope is too hard for riding animals, one has to take the ascent of the pass in zigzags. On the southern side of the pass we had 16.2 km. to *Camp CCXXXII*, *Tsumtul-pu-gompa* where the altitude is 4,863 m. being a descent of 806 m. and a fall of 1:20.1.

The lamas of *Diri-pu-gompa* gave me some information about the source or the *Indus* which I, a few days later, had an opportunity to check. When I asked in what direction the source was, they pointed to the N. 40° E. The valley of *Diri-pu*, which farther west joins the *Dunglung* and the *Chamo-lungchen*, they called *Ham-chuchen*. There was said to be a road up in the *Dunglung* valley leading in one day to *Dunglung-la*, and thence in two days to the *Singto-dokpas* or nomads of *Singtod* on both sides of the uppermost *Indus*. *Komcham-chu* is the name of the little valley by which the *Kailas* is visible to the south as on Pan. 318, Tab. 57. Pilgrims wandering around the *Kang-rinpoche* are allowed to get shelter for the nights in the monasteries around the mountain, and they do not need to pay anything.

Leaving the *Tseti* valley with the road to the source of the *Indus* to our left, and crossing its brook of about 1½ cub. m. per second, on a little bridge of stone and wood, we began, immediately from its left bank, to climb towards the heights of *Dolma-la*. Then we have to our right or south the upper part of the *Ham-chuchen* which, in spite of its being a tributary, has much more water than the main river. But it comes from the ice and snows of the *Kailas*. The *Kailas* group has no water-parting importance, as all the brooks coming from it belong to the *Satlej* System. The water-parting between the *Indus* and the *Satlej* is situated north of the *Kailas* on the *Tseti-lachen-la*, 5,466 m. high. The *Kailas*, therefore,

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<sup>1</sup> On the fourth phot. opposite p. 210 of Vol. II the opening just mentioned is easily recognizable. The direction is here N. N. E. and not north.



has the same position as the high *Himalaya* peaks which are situated south of the water-parting.

Our, and the pilgrims', road rises in hundreds of zigzags on the steep slope between the brook from *Tseti-la* and the one from the *Kailas*. There are heaps of gigantic granite blocks, between which the road winds sometimes more like a corridor. On every block there is a heap of small stones. A comparatively even place or platform, where the pilgrims take a rest, is particularly full of blocks with stone-heaps, a kind of votive offerings. From this place Pan. 380, Tab. 57, was drawn, showing the glacier which seems to be fed from the northern side of the *Kailas*. The peak is visible to the S.  $15^{\circ}$  W. A view from the N. E. is found in Vol. II, p. 212. The glacier is very short and compact. It has moraines both on its top, at its sides and front, though very small. The *firn* basin feeding the glacier is also small and with sharply defined boundaries. Its southern boundary seemed to be formed by a ridge which stretches eastwards from the *Kailas* and is covered with snow, abruptly cut off to the north and showing dark stripes of solid material. From this glacier most of the water flows to the tributary to our right.

South of us we have two small deep-cut valleys with snow-covered, though not very high, mountains in their background. Between them is a ridge ending in a steep and sharp point. It consists of vertically cleft and split granite, which by the agencies of destruction, has been formed into innumerable very sharp pyramids separated from one another by dark, nearly black gorges. The *Kailas* thus is protected on the north by a wall of granite, reminding one of the Somma around the Vesuvius, though in the case of the *Kailas*, this wall is interrupted and formed into irregular ridges. The peak itself seems to consist of the same sandstone conglomerate as mentioned from *Nyandi-gompa*, and the stratification seems to be the same as there.

The gravel and blocks of all sizes we climb amongst, consist of several varieties of granite, coarse or fine-grained, grey, white or pink, *etc.*

From the next resting place, *Tutu-dapso*, we see a second little glacier, and a new sharp-edged mountain at the left side of the valley. Here we pass a perfect forest of stone pyramids built by devout pilgrims. It looks like a burial place with innumerable sepulchral monuments. From here a considerable snow-covered peak is seen to the S.  $85^{\circ}$  W. Its name was said to be *Chong-gonmamo-chapta*. A mount just west of the second glacier was called *Tapchung-napga*, and a peak above the same glacier, *Kandu-sanglam*. East of the bed of the same glacier a peak was said to have the name *Na-toma-laypotang*. I do not know in how far these names are reliable. But the old pilgrims who gave them also mentioned some names on the way to the source of the *Indus* which proved to be correct.

It was hard work to climb the pass. We seemed never to reach the top. A little farther on it became visible that the *firn* basin of the second glacier at least partly was in connection with the *névés* of the first glacier. The view increases in grandeur the higher we reach. Sometimes one has the impression of walking between low stone-houses and walls in villages when the pilgrims' road is winding between the blocks. The several religious customs of the pilgrims, I have described in my personal narrative. Some of the blocks are round, others sharp-edged, all are grey, and all sizes are represented, from small blocks to quite gigantic ones. Sometimes one can rather talk of a block-scrée with steps trodden for centuries by thousands of pilgrims.

The last slope up to the pass is very steep and full of blocks. To our right is a considerable mountain covered with snow which on its surface is formed into ice, shining like pure white metal. A part of it forms a little hanging glacier, the edge of which is abruptly broken off. To the north of us is a pass of no importance, as it leads to the *Tseti* valley only. Our track follows the top of a ridge of blocks with small rillets at both sides. There is no interruption in the series of blocks with pyramids of votive-stones on the top. In bad weather and snow they show the road.

The *Kailas* is not in sight. From the pass itself it is also hidden. On the pass there is a gigantic block with poles and rags as shown on Pan. 321, Tab. 58. The same panorama shows the *Kailas* group so far as it is visible from *Dolma-la*. The view is magnificent. To the south is the little hanging glacier mentioned above. The little lake on the other side of the pass is not yet visible, but we see the ice which stretches down from the mountain and is cut off at its southern shore.

Near the pass the living rock is the same as before; »graue, biotit- und hornblendeführende Granite (Quartzbiotit-diorite)» is the diagnose given by Professor Hennig.<sup>1</sup> There is also »glimmerreiche Verwitterungsmasse».

From the pass our road goes down very steeply between thousands of blocks to the little lake, called *Tso-kavála* by the pilgrims. On p. 212, Vol. II, is a photo of it, showing the ice-edge standing vertically at its southern shore. The pilgrims' road follows the northern shore. Here is a belt of open water from 1 to 5 m. broad; the rest of the little lake, or rather pool, was frozen. The ice was white and full of cracks. Along the southern shore the ice seemed to be very rotten. Our guide said the lake never becomes quite ice-free. It is a moraine-lake.

Having passed *Tso-kavála* we again descend steeply as before. To our right the wild rock walls continue, as seen on the last-mentioned panorama, and photo. The rocks are vertically cleft as hitherto. There are fantastic formations like pyramids and towers and one pillar had the form of a mushroom. When these formations crumble the scree of blocks increase.

<sup>1</sup> Vol. V, p. 105.

The last section of the road down to the *Tselung* valley is extremely steep, a series of zigzags amongst gravel and natural steps. The *Tselung* valley comes from the N. N. W. At its left or eastern side is seen a small hanging glacier on a high rock. Where the valley from the eastern side of *Dolma-la* joins the *Tselung* valley, the altitude is 5,301 m. At the junction a sheepfold of stone was built at the side of a large block. A pilgrim whom we met here told us that the *Tselung* valley has this name only in its upper half, and is called *Lam-chüker* lower down. It comes from a pass, *Tsemo-la*, which is not far from *Tsete-la* (*Tseti-la*, as it was pronounced by other Tibetans). *Tsete* was the name of the region in which these two passes are situated. It is not inhabited. From the place, at 5,301 m., the *Singi-kabab* or source of the *Indus* could be reached in two days, which also proved to be correct.

From the junction our direction becomes S. S. W. The ground is covered with tussock-grass and is swampy from many small rills from the mountains. The *Tselung-chu* had a good deal of water. On the sides grey granite as before, vertically cleft. There are everywhere signs of camps and campfires. *Kando-sanglam* is a considerable valley from the right. In the background of this valley, which carried a considerable brook, a part of the *Kailas* is again visible (Vol. II, p. 212).

Two *mani* walls built parallel with one another indicate the place where the granite comes to an end, and the sandstone and conglomerate again begin. Granite, however, prevails for a while amongst the gravel and the blocks in the bottom of the valley, but by and by the sandstone débris become more common. The first mountain shoulder at the left side of the valley, consisting of horizontally stratified sandstone and conglomerate, is called *Shalma-ri-dongbo*; between it and the last granite mass is a small nameless valley. From the right another valley opens out, through which the afternoon sun was shining, the rest of the main valley being in the shade. Antelopes were seen grazing and not shy at all, as nobody kills them here.

Our road follows the base of a block scree. A *chorten* is passed. From the left the valley *Topchen* enters, being of the same size as the *Tselung*. It comes from the pass, *Topchen-la*, which probably is situated in the same range as the *Tseti-lachen-la*.

Our valley is broad and the road improves. There are many *manis* and *chortens*. Blocks become less numerous, and mostly consist of sandstone and conglomerate. Mighty mountain ridges rise both to the right and left always with the characteristic, nearly horizontal, stratification.

At *Tsumtul-pu-gompa*, *Camp CCXXXII*, the altitude was 4,863 m. The living rock was yellowish grey sandstone-conglomerate falling from 2° to 12° to the S. 30° E. Blocks and gravel in the neighbourhood consisted of fine-grained conglomerate. A spring comes up at the place protected by stone walls. *Tsumtul-pu* is a

solid, well-built monastery of the same kind as the others around the *Kailas*. The best place for the night is on its roof. In the temple hall there is a pair of elephant tusks, just as in *Nyandi-gompa*. There are four lamas subject to *Tarchen-labrang*.

The last day of the excursion, *September 5th*, took us 17.6 km. W. S. W. from 4,863 m. to 4,629 m. at *Khaleb*, a descent of 234 m. or as 1:75, though the fall is not regular, as we made a short visit to *Tarchen-labrang*.

The road down from *Tsumtul-pu-gompa* is very rich in *manis*. The descent is gradual and comfortable, the road good, and situated on the top of the right terrace. The river of *Dopchen-chu* is considerable; as a rule it is streaming in one bed, sometimes in two or three branches. From the right a comparatively large tributary enters; at the right side of its mouth the strata are very folded. On both sides of the main valley mighty peaks are rising, being the last sharp-edged ramifications, below which the forms become more moderate and rounded, until the last hills finally merge into the plain north of the *Rakas-tal*. The lake itself is visible, shining blue with the brilliant *Gurla-mandata* to the south.

At one place where the river is pressed together in a very narrow gorge, we have to pass on the slopes above the valley. Here the round blocks of several cubic meters in size, are generally granite. The living rock is dark dense limestone dipping  $44^{\circ}$  N.  $20^{\circ}$  W., and crossed by numerous veins of calcspar. The river is foaming and boiling between perpendicular rocks. Weathered granite, sandstone and conglomerate are also to be found. The next specimen of rock is dolomitic and magnesitic weathering-products dipping  $36^{\circ}$  W. Grey magnesitic mass stands in a narrow belt vertically from N.  $47^{\circ}$  W. to S.  $47^{\circ}$  E. Then follows brownish magnesitic mass and greyish green sandstone-conglomerate dipping  $71^{\circ}$  S.  $10^{\circ}$  W. Reddish brown limestone and dark-green serpentine, in  $85^{\circ}$  S.  $15^{\circ}$  W., were standing at a cairn on the right side of the valley. A large part of the débris in the valley consists of green serpentine. A short distance below the cairn there is white quartz.

The *Dopchen-chu*, after leaving the mountains, seems to cross the plain to the S.  $29^{\circ}$  W. and is certainly identical with the brook of *Parke*, or the branches we crossed just west of *Parke*. The *Kailas* is not at all in sight. Several *manis* are passed. On the left side of the river were two nomad-tents and flocks of sheep. At a place in the very mouth of the valley where two big *manis* were built, the altitude is 4,689 m. Below this place there are still several *manis*, which indicate the neighbourhood of the sacred *Kang-rinpoche* and its temples.

Our road now turns to the N. W., crossing the last slopes from the *Kailas* group. The road is excellent. To our left is the extended plain, and in the distance *Parke* is just visible. Below our road there is a good deal of bush vegetation. From the right or north a valley comes out with a little brook. A *mani* along the road

is about 100 m. in length, but not well-built. At *Tarchen-labrang* several white tents of merchants were pitched. There were no buildings at this place, and we did not continue up the valley. Of the four monasteries surrounding the *Kang-rinpoche*, *Nyandi*, *Diri-pu*, *Tsumtul-pu* and *Gyangta*, I do not know anything of the last-mentioned, which probably has a more hidden situation at the side of the pilgrims' road. I got the impression that the *Gyangta-gompa* was situated in the upper reaches of the valley of *Tarchen-labrang*, through which a road comes down. At *Tarchen-labrang* we had an altitude of 4,710 m. In the background of the valley of *Tarchen* a part of the peak of the *Kailas* is visible. Then it disappears again until we have approached *Khaleb* at some distance.

At the N. W. corner of *Rakas-tal* or *Langak-tso*, a curious local wind was blowing, whirling up greyish white clouds of dust along the ground, whereas other parts of the plain were untouched by the wind.

We cross many dry erosion beds. The ground consists of clay and gravel and there are many bushes. The river from the *Nyandi* valley is streaming in its 6 or 7 m. deep bed, the erosion terraces of which consist of gravel, sand and small blocks.

From this place we had still 4 km. W. S. W. to *Khaleb*, *Camp CCXXX*, where the caravan was waiting, and from where the next crossing of the *Transhimalaya* was to start.

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## CHAPTER XXXI.

### CROSSING THE TRANSHIMALAYA FROM KHALEB TO GYÄKUNG AND THENCE TO GARTOK.

The crossing from *Khaleb* to *Gyäkung*, *Camp CCXLI*, is, chronologically, the fourth I undertook across the *Transhimalaya*, and from the point of view of geographical situation from east to west, the seventh. As mentioned in the preceding chapter, *Camp CCXXX*, *Khaleb*, was at 4,629 m., *Diri-pu-gompa* or *Camp CCXXXI*, at 5,091 m., the ascent 462 m. and the rate 1:43.5, as the distance was 20.1 km.

My second camp at *Diri-pu-gompa*, *September 7th*, *Camp CCXXXIII*, was not exactly at the same place as the first one, or *Camp CCXXXI*, but as the distance between the two was extremely short, the altitude was practically the same or 5,091 m. From there we had 12.3 km. N. N. E. to the pass *Tseti-la*, 5,628 m. high, a rise of 537 m., or 1:23. The water-parting pass between the *Satlej* and the *Indus* is, however, *Tseti-lachen-la*, 5,466 m. high, and situated 4.7 km. N. N. W. of *Tseti-la*, about one kilometer beyond *Camp CCXXXIV*, *Sände-buk*, 5,458 m. high. The fall between the two passes is, therefore, 162 m. or 1:29. From *Tseti-lachen-la* we had 23 km. N. N. E. to *Camp CCXXXV*, *Singe-buk*, with an altitude of 5,079 m. or 387 m. below the pass, being a fall of 1:59. The last-mentioned camp was reached on *September 9th*.

Pan. 314, Tab. 57, is a view of the *Kailas* from the *Tseti* valley. Pan. 322A and B, Tab. 58, is drawn from *Tseti-la* and shows the flat, rounded hills near the crest, and no distant view. Pan. 325, Tab. 59, is taken from a point 2 km. S. W. of *Camp CCXXXV*, and shows the mountains rising on the right or northern side of the *Indus* just above the camp. A part of the same mountains is also visible on Pan. 324, Tab. 58, which was sketched from *Camp CCXXXV*, *Singe-buk*. To the N. 66° W. the valley of the *Indus* is seen.

From *Singe-buk* we had 11 km. E. S. E. to the source of the *Indus*, *Singikabab*, *Camp CCXXXVI*, at an altitude of 5,165 m. or 86 m. higher, the rise being 1:128. Pan. 323A and B, Tab. 58, shows the surroundings of this important place, with mountains of moderate size to the south belonging to the same *Transhimalayan Range* as the one of *Tseti-lachen-la*.

The next day's march, *September 11th*, took us 16.5 km. N. E. across the secondary pass of *Jekung-la*, 5,294 m. high, to the first class pass of *Lamo-latse-la*, 5,426 m. high, and situated on the continental water-parting of the *Transhimalaya*. The rise to the pass was 261 m., or as 1:63. From the pass to *Camp CCXXXVII*, the distance was 3.7 km. and the descent 250 m. or as 1:15. It was thus an exception from the morphological rule, according to which the northern slope, as a rule, has a more gradual gradient than the one to the south. *Lamo-lachen-la* is on the water-parting between the *Indian Ocean* and the *Chang-tang* plateau-land without outlet to the sea.

On Pan. 327, Tab. 59, taken from *Jekung-la* we see to the N. 60° E. the *Lamo-latse-la* on our road, the valley of the *Bokar-tsangpo* to the S. 61° E., a peak *Yama-koto* to the south, and to the S. S. W. two passes *Dopchen-la* and *Hle-la*, probably situated in the same range as the *Tseti-lachen-la*. From *Lamo-latse-la* Pan. 328, Tab. 59, was drawn to the west, and Pan. 329, Tab. 59, to the east. The *Kailas* is in sight from none of these passes.

On *September 12th*, we travelled 19.5 km. E. N. E. and N. E. to *Camp CCXXXVIII*, *Dam-tärngo*, at an altitude of 4,991 m., or a descent of 185 m. at a rate of 1:105. From a point 7 km. N. 70° E. of *Camp CCXXXVII* Pan. 331, Tab. 59, was drawn to the N. E. and Pan. 332, Tab. 59, to the S. W. Pan. 330A and B, Tab. 59, is from *Dam-tärngo* and shows a region of flat mountains all around without any prominent peaks.

From *Camp CCXXXVIII* our road goes N. E. for 8.3 km. to the pass, *Dam-karchen-la*, 5,099 m. high, being an ascent of 108 m. or 1:77. From the pass we had 13 km. to *Camp CCXXXIX*, *Gyamboche*, at 4,804 m., or a descent of 295 m., at a rate of 1:44. Pan. 333, Tab. 59, is taken from a little threshold E. N. E. from *Camp CCXXXVIII*, giving a view to the S. W., and to the S. 56° W. *Lamo-latse-la* is visible. Pan. 334, Tab. 60, is taken from the same point, and gives a view of distant ridges to the N. N. E. Pan. 335, Tab. 60, is from a point between *Dam-karchen-la* and *Tsalam-ngopta-la*; it shows distant mountains to the W. S. W., west and W. N. W., which probably belong to still unknown ranges of the *Transhimalaya*, running N. W.—S. E. Pan. 336, Tab. 60, is taken from *Tsalam-ngopta-la* to the north and N. N. E. and gives a good view of the plateau-land with its comparatively low ridges and flat depressions.

On *September 14th*, we travelled 20.1 km. N. N. E. and N. E. to *Camp CCXL* at an altitude of 4,624 m., or a descent of 180 m. and at a rate of 1:112. The panorama taken from this camp, 339, Tab. 60, represents a comparatively low range to the north of the basin of *Mugu-telep* with its shallow salt pools.

The last march of this section across the *Transhimalaya*, on *September 15th*, took us east and E. N. E. for 10.5 km. to *Camp CCXLI*, *Gyäkung*, at an altitude of 4,802 m., the ascent thus being 178 m. and the rate 1:59.



THE PLAIN OF CHANG-MALUNG BETWEEN CAMP 243 AND CAMP 244.





The whole distance along this section is, therefore, 162.7 km.

The fifth section of the *Transhimalaya* starts from *CCXLI*, *Gyäkung*, and comes to an end at *Gartok*. The first day's journey goes westwards to *Camp CCXLII*, *Govu*, a distance of 14.1 km. passing *Camp CCXL*. From the latter to *Camp CCXLII* the distance is 3.6 km., the rise 36 m. and the rate 1:100. From the latter camp, Pan. 338, Tab. 60, is drawn, being a view of the country to the N. N. E. and N. E.

The second day's march, *September 18th*, proceeds 23 km. N. W. to *Camp CCXLIII*, *Luma-rigmo*, at an altitude of 4,614 m. The fall is 46 m. and the rate 1:500. Pan. 341A, B and C, Tab. 60, is taken from *Luma-rigmo*. It gives an idea of the morphology of the country around. To the S. W. and W. S. W. it has a region, *Chang-molung*, which obviously is comparatively extended, for on the map it is also placed farther north; it seems to indicate a large plain. S. 81° W. is *Ri-maru*, a flat pyramidal peak. *Talung-tebötö* is a range remaining north of the next day's road. To the N. E. and E. N. E. is the depression, *Ngongba-mangba*, which certainly is more extended than on the map, Pl. 13. To the S. E. is the flat valley by which we have arrived, with the small lakes, *Tsokar-tso* and *Pul-tso*, indicated on Pan. 337, Tab. 60.

On *September 19th*, our road is 28.2 km. long and proceeds westwards to *Camp CCXLIV*, *Sari-yol*, with an altitude of 5,021 m. The rise is 407 m. and the rate 1:69.

The march of *September 20th* has to be subdivided into three parts. The first, 6 km. run S. W. to *Bokar-la*, 5,178 m. high. The rise is 157 m., the rate 1:38. The next 14.8 km. W. S. W. reach the *Indus* at an altitude of 4,979 m. The fall from the pass to the river is 199 m. or as 1:74. The last, 11.3 km. run W. N. W. to *Camp CCXLV*, *Sambuk-sumdo*, where the altitude is 4,698 m., and the *Indus* enters from the left. Here the fall is 281 m., or as 1:40. From *Bokar-la* Pan. 340, Tab. 60, is taken. Its range of sight is not great, and no high mountains are visible. Pan. 342, Tab. 60, taken from *Sambuk-sumdo*, shows to the S. 77° E. the little valley from which we have arrived. Pan. 343, Tab. 60, is a sketch of the same valley downwards to the N. 62° W.

On *September 21st*, we marched along the right bank of the *Indus* 10.1 km. to the N. W. to *Camp CCXLVI*, *Hlagar*, where the altitude is 4,672 m. or 26 m. below the previous camp, the rate of fall thus being 1:388. From the source of the *Indus* to *Hlagar* the distance may be calculated at 100 km. On this stretch the fall would be 493 m. or as 1:203. From *Hlagar* to the confluence with the *Gartang* at *Camp CCLVII*, where the altitude is 4,254 m., and to which place the distance is 187 km., the river falls 418 m. or at a rate of 1:447. From the confluence to *Camp CCLXIV*, *Lungkung*, a distance of 100 km., the river falls from 4,254 to 4,179 m. or 75 m., the rate being thus 1:1,333. The fall gradually diminishes.

Pan. 344, Tab. 60, is taken from a point at 4,979 m., 11 km. S. E. of *Sambuksumdo* and shows the hills to the E. N. E., east and S. S. E. Pan. 345A and B, Tab. 61, is taken from *Hlagar*, and gives an idea of the high *Indus* valley around this place.

On *September 22nd*, we marched 21.2 km. W. S. W. and S. W. to *Camp CCXLVII, Dotsa*, at an altitude of 4,885 m. The rise is 213 m., or at a rate of 1:100. Three passes are crossed on this road, *Tarruki-la*, *Särtsoki-la* and *Dotsa-la*, the two last-mentioned being higher than *Camp CCXLVII*.

Pan. 348A and B, Tab. 61, is drawn from *Särtsoki-la*, 5,028 m. high. To the E. S. E., it shows rather distant mountains, and at no great distance a little lake or pool. To the N. 74° W. is a more considerable mountain which may perhaps be situated between the Upper *Indus* and the *Lang-chu*. Pan. 346, Tab. 61, is drawn from *Dotsa-la*, 5,045 m. high. To the W. S. W., S. W., and S. S. W. it shows ridges and peaks as far as the eye sees. Pan. 347A and B, Tab. 61, is taken from *Camp Dotsa* and gives a new aspect of the barren, weathered and desolate mountains of this part of *Tibet*.

To *Camp CCXLVIII, Nyanda-nakbo*, 4,855 m. high, we travelled in a W. S. W. direction for 31.3 km. on *September 23rd*. The fall is only 30 m. or as 1:1,043, though places a hundred metres lower are passed on the road. Pan. 349A and B, Tab. 62, is drawn from *Camp CCXLVIII*. It shows to the S. 53° W., the *Jukti-hloma-la* which we had to cross two days later. To the N. W. and N. N. W. of the camp is a ridge called *Kul-karu*.

On *September 24th*, our direction was W. S. W., the distance 14.5 km. to *Camp CCXLIX, Takto-serpo*, where the altitude is 5,166 m. or 311 m. above the preceding camp, the rate being 1:46.6.

The next day, *September 25th*, we crossed the highest pass on this road, *Jukti-hloma-la*, 5,825 m. high. We had 13 km. S. W. to reach it, rising 659 m., or at a rate of 1:19.7.

On the western side we had 9.4 km. W. N. W. to *Camp CCL, Dung-lungsumdo*, at an altitude of 5,171 m., the fall being 654 m. or at a rate of 1:14.4. The *Bokar-la*, though only 5,178 m. high, is of much greater importance, being situated on the continental water-parting.

The last day's journey on this section goes S. W. and W. S. W. for 19.4 km. to *Gartok, Camp CCLI*, where the altitude is 4,469 m. The fall is, therefore, 702 m. and the rate 1:27.6.

The whole crossing, according to this calculation, would be 216.3 km. The result I got from the construction map was 216.9 km. (*Vide* Vol. III, p. 336.)

The surroundings of *Gartok* are seen on Pan. 350A, B and C, Tab. 62. From here the journey continues as described on p. 181 to p. 203 in this volume.



VALLEY OF THE BUPTSANG-TSANGPO.





IN THE VALLEY OF THE BUPTSANG-TSANGPO.



## CHAPTER XXXII.

### FROM CHUNIT-TSO TO USHÜ.

We now have to consider, in chronological order, my sixth crossing of the *Transhimalaya*, being the fifth if we reckon from east to west. This route, from *Camp CCCLXXI* on the western shore of *Chunit-tso* to *Camp CCCXCV*, *Ushü*, near the *Tsangpo*, has been described in Vol. III, p. 316 *et seq.* It now remains to say a few words about the distances, the gradients and the panoramas.

*Camp CCCLXXI*, *Sninkuk*, has an altitude of 4,747 m. On *April 3rd*, we travelled south 11.3 km. to *Camp CCCLXXII*, *Kemar*, at 4,846 m. The rise is 99 m. and the rate of ascent 1:114. Pan. 451, Tab. 84, is a view to the N. W., north and N. E. from the latter camp.

On *April 4th*, the journey continued S. S. W. and south for 4 km. to the pass, *Nima-lung-la*, 4,882 m. high, a rise of 36 m. at a rate of 1:111. South of the pass we had 10.8 km. to *Camp CCCLXXIII*, 4,784 m. high, being a fall of 98 m. at a rate of 1:110. On these two marches we crossed, therefore, a rather low range, running east and west.

Pan. 453<sup>A</sup> and B, Tab. 85, is drawn from *Camp CCCLXXIII*. To the S. 17° E. is a mountain called *Ri-sema*, to the S. 33° W. our road of the next day continues to the valley of *Buptsang-tsangpo*. To the S. S. W., south, S. W. and west is the N. E. side of the mighty *Lunkar Range*. To the N. W. and north from where we have arrived, are moderate, rounded hills.

On *April 5th*, we covered 16.4 km. S. W. over very gradually rising ground, ascending only 22 m. to *Camp CCCLXXIV*, at an altitude of 4,806 m., the rate being 1:745 only. Pan. 454, Tab. 85, is taken from the latter camp. The greatest part of the *Lunkar Range* is now hidden behind lower hills in front of it.

On *April 6th*, our road went S. S. W. and south for 9.8 km. to *Camp CCCLXXV*, *Monlam-kongma*, at 4,822 m., or a rise of 16 m. at a rate of only 1:613. We were now in the valley of the *Buptsang-tsangpo* which we had to follow several days to the S. S. E. up to *Samye-la*. The panorama, 457<sup>A</sup> and B, Tab. 86, taken from *Camp CCCLXXV*, is of great orographical interest as it gives us a very vivid



impression of the *Lunkar Range*, and shows that it has a bastion of rounded hills and ramifications at its N. E. base. At some places high snow-covered peaks rise above these hills, and to the N. W. we see its slopes and ramifications in a foreshortened perspective. To the S. 20° E. we catch a first glimpse of one of the highest peaks of the *Lunpo-gangri*, or *Lombo-kangra* as we heard it called, from the south.

Following the *Buptsang-tsangpo* upwards, on *April 8th*, 13.9 km. S. S. E. to *Camp CCCLXXVI*, *Amchung*, we ascend only 13 m. or to 4,835 m., the rate thus being 1:1,069 only. Pan. 455, Tab. 85, shows a new aspect of the *Lunkar Range* with some of its mighty snow-covered peaks, and to the S. S. E., our further way up to the continental water-parting.

The 9.6 km., covered on *April 9th*, take us S. S. E. to *Camp CCCLXXVII*, where the height is 4,883 m., a rise of 48 m. and a rate of 1:200. From the new camp a new panorama, 456, Tab. 85, was sketched, giving a new view of the mighty *Lunkar-gangri* and showing its ramifications to the N. W. as in profile. To the S. 23° E. the highest peak of the *Lunpo-gangri*, just appears above the horizon.

The next day's march, *April 10th*, proceeds S. S. E. and S. E. for 13.7 km. to *Camp CCCLXXVIII* at an altitude of 4,905 m., or 22 m. above the previous camp, being a rise of 1:623. Pan. 458A, B and C, Tab. 86, taken from the last-mentioned camp, is very instructive, as it commands two mighty mountain systems of the *Transhimalaya*. To the S. 18° E. we have the steep and high peak of the *Lunpo-gangri* group, and S. 14° E. its more flat neighbour. To the S. W., west and N. W. is the *Lunkar Range*, its highest crest being hidden by lower nearer hills. To the N. 19° W. is the valley of the *Buptsang-tsangpo*. From N. 5° E. to N. E., east and S. E. are mighty snow-covered peaks of the *Kanchung-gangri*, the range on the right or eastern side of the valley of the *Buptsang-tsangpo*.

The road to *Camp CCCLXXIX*, *Bupyang-ring*, at an altitude of 4,911 m., proceeds, *April 11th*, 13.8 km. S. S. E. The rise is, therefore, only 6 m. and the rate 1:2,300. It is interesting to notice the extremely flat gradient in the valleys between the parallel ranges of the *Transhimalaya*. The panorama, 461A and B, Tab. 87, from the last camp, is important. It shows to the W. N. W., parts of the *Lunkar Range*, to the N. 25° W., the valley of the *Buptsang-tsangpo*, to the north, east and S. E., parts of the *Kanchung-gangri*, to the S. 13° E., the steep peak of *Lunpo-gangri*, to the S. 5° E., S. 9° W. and S. 29° W., other peaks of the same group, and to the S. W., hills hiding the *Lunkar Range*. In Vol. III, p. 318 the second watercolour panorama is also taken from *Camp CCCLXXIX*. Both were taken at the spot, the black one on *April 11th*, the coloured, *April 12th*. The latter is, therefore, not simply a copy of the first, and the colours are as near the real colours in clear weather as I could come.

To *Camp CCCLXXX*, on *April 13th*, at a height of 4,968 m., we had 11.5 km. south. The altitude increased 57 m. and the rate of rise was 1:202. From this camp Pan. 459A and B, Tab. 86, is sketched. It shows to the S. 46° W. a fine pyramidal peak belonging to the *Lunpo-gangri*, which itself is simply the S. S. E. continuation, and a part of the *Lunkar Range*. The latter comes to an end at N. 22° W., the direction in which the valley of the *Buptsang-tsangpo* goes down to *Tarok-tso*. To the N. N. W., north and N. N. E. we see some of the peaks of the *Kanchung-gangri* in a foreshortened perspective.

The next march, *April 14th*, takes us S. S. E. and S. E. 8.2 km. to *Camp CCCLXXXI* at an altitude of 5,370 m., or a rise of 402 m. at a rate of 1:20.4. Here the real ascent to the continental water-parting begins. Before reaching the camp we had to cross a secondary threshold with an altitude of 5,430 m. From the height of this pass, Pan. 460A and B, Tab. 86, was drawn showing the characteristic steep peak of the *Lunpo-gangri* to the S. 12° E., and to the right of it, other parts of the same group. From *Camp CCCLXXXI*, *Bupto*, the coloured panorama in Vol. III, p. 319, was made. These two panoramas are nearly the same, as the distance between the two observation points is only 1 $\frac{3}{4}$  km. Only the angles and shadows have changed a little.

On *April 15th*, we crossed the continental water-parting in *Samyela*, 5,527 m. high, situated not on the crest of a range, but in the latitudinal valley between two ranges, viz., the *Lunpo-gangri* and *Kanchung-gangri*. From *Camp CCCLXXXI*, we had 8.5 km. S. E. to *Samyela*, a rise of 157 m. or as 1:54. On the southern side we had 3.4 km. S. E. to *Camp CCCLXXXII* at an altitude of 5,366 m., or a descent of 161 m. at a rate of 1:21. The slope on the southern side is, therefore, more than 2 $\frac{1}{2}$  times as steep as on the northern. Pan. 462, Tab. 87, is taken from the pass, and shows the high peaks of *Lunpo-gangri* under quite a new perspective. From *Camp CCCLXXXII* the two small coloured panoramas, Vol. III, p. 318 (the second illustration) were taken, showing that the whole mountains are covered with snow and ice, with the black rock peeping through only here and there.

On *April 16th*, we travelled E. S. E. for 13.3 km. to *Camp CCCLXXXIII*, at an altitude of 4,945 m., or a descent of 421 m. and at a rate of 1:31.5. Pan. 463, Tab. 87, shows a part of the *Kanchung-gangri* with its bulky, compact mountain masses. The first and uppermost watercolour panorama, p. 318, Vol. III, is taken from the same camp and is a view of the *Lunpo-gangri* peaks. The peak visible to the S. 76° W. is the same as I have called the steep one, and which is to be recognized on several of the panoramas, for instance Pan. 460A, Tab. 86, to the S. 12° E. We now find that this peak is very narrow and steep when seen from the E. N. E.

On *April 17th*, we travelled 14 km. E. S. E. and S. E. to *Camp CCCLXXXIV*, at an altitude of 4,832 m., or a descent of 113 m. and a rate of 1:124. Pan. 465, Tab. 88, gives a view of the *Rukyok* valley down along our road the next day.

On *April 18th*, we travelled 15.3 km. S. S. W. down the *Rukyok* valley to *Camp CCCLXXXV*, at an altitude of 4,696 m. or a descent of 136 m. at a rate of 1:112.5. Pan. 464, Tab. 87, is a view to the S. E., south, S. W. and W. N. W. from the latter camp; the mountains visible on it are situated near the camp and hide every distant perspective. The next day's march takes us 11.8 km. S. E. down the *Rukyok* valley and a little bit up the valley of the *Kanchung-chu* or *Chaktak-tsangpo* to *Camp CCCLXXXVI*, *Charte*, where the altitude is 4,634 m., a descent of 62 m. and a rate of 1:190. From this camp Pan. 466, Tab. 88, is drawn to the E. N. E. up into the *Chaktak* valley. Pan. 467, Tab. 88, is taken from the same place to the S. S. W. down the valley of the *Chaktak-tsangpo*.

On *April 20th*, we marched 13.8 km. east and E. N. E. up the valley of *Kanchung-chu*, which is the Upper *Chaktak-tsangpo*, to *Camp CCCLXXXVII*, at an altitude of 4,702 m. The ascent is 68 m. and the rate 1:203. Pan. 470A and B, Tab. 88, taken from there shows only the mountains surrounding the valleys, the most important of which is the one to the N. 12° W., for here the Upper *Chaktak-tsangpo* comes down from *Lapchung-tso*.

On *April 21st*, we travelled 13.7 km. S. E. up the valley of the *Gyäbuk-chu* to *Camp CCCLXXXVIII*, where the altitude is 4,865 m., or a rise of 163 m. and at a rate of 1:84. Pan. 471, Tab. 88, is drawn from this camp and shows a comparatively bulky peak to the N. 25° E. and more open land to the east and E. S. E.

Farther up the same valley to the E. S. E. and E. N. E., we had 12 km. to *Camp CCCLXXXIX* at an altitude of 5,001 m. The ascent is 136 m. and the rate, 1:88. Pan. 468, Tab. 88, is a view to the S. 88° E. from this camp, and Pan. 469, Tab. 88, shows the valley down to S. 50° W.

On *April 23rd*, we travelled east and E. S. E.; first, 6 km. to the pass, *Gyäbuk-la*, 5,175 m. high, a rise of 174 m. and a rate of 1:34. From the pass to *Camp CCCXC*, 5,079 m. high, we had another 6.3 km. with a fall of 96 m. at a rate of 1:66. The small panoramas, 473 and 474, Tab. 88, are views of valleys near the last camp.

The next day we had 10.6 km. E. S. E. to *Kinchen-la*, 5,441 m. high, a rise of 362 m. at a rate of 1:29, and another 3.6 km. E. S. E. to *Camp CCCXCI*, at an altitude of 5,209 m. or a descent of 232 m. at a rate of 1:15.5. Pan. 475, Tab. 88, is a view from the pass to the N. E. and E. N. E., showing a part of the range called *Lombo*, south of *Kanchung-gangri*. Pan. 477, Tab. 88, is also from *Kinchen-la* and is of interest as it contains a part of the *Chomo-uchong* to the S. W. and a part of the *Lunpo-gangri* to the W. N. W. Pan. 476, Tab. 88, is taken from a point a little east of *Kinchen-la* and gives an idea of the mountains to the east and E. S. E. on both sides of the *Raga-tsangpo*.

To *Camp CCCXCII*, *Rapak-do*, at an altitude of 5,103 m., we had 9.6 km. E. S. E. and S. S. E., descending 106 m. or at a rate of 1:91. At *Rapak-do* Pan. 478,

Tab. 89, was sketched, showing to the north and N. E. the *Lombo Range*, the name of which is, of course, the same as *Lunpo*, though it is a different range.

On *April 26th*, we travelled 17.7 km. south and S. W. to *Camp CCCXCIII* where the altitude is 4,656 m., a fall of 447 m. or at a rate of 1:40. On the road the little pass of *Kule-la* is crossed at 5,088 m.

To *Semo-ku*, *Camp CCCXCIV*, we had, *April 27th*, only 3.5 km. S. S. W., descending 60 m. to an altitude of 4,596 m., the rate of fall being 1:58.

The last day's march on this section was 12 km. to the S. W. and W. N. W. to *Camp CCCXCV*, *Ushü*. Here, at the southern base of *Chomo-uchong*, we were practically on the same level, descending only to 4,542 m. and again rising to 4,563 m. at *Ushü*. Pan. 481, Tab. 89, gives an idea of the little village of this name.

According to this calculation, the whole road had a length of 298 km. According to the measurement along the road on the construction map, it was 289.3 km.

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## CHAPTER XXXIII.

### FROM USHÜ TO TERI-NAM-TSO.

My road from *Ushü* across the *Transhimalaya* to *Camp CCCCXI* on the southern shore of *Teri-nam-tso* has been described in Vol. III, p. 306 *et seq.*

The first day's march, *April 30th*, took us 9.5 km. west and N. W. to *Gyā-la* at an altitude of 4,918 m. The rise from *Ushü* is, therefore, 355 m. and the rate 1:26.8. From the pass we had 7.4 km. N. N. W. to *Camp CCCXCVI*, *Lumbo-taktsen* at an altitude of 4,780 m., a fall of 138 m., at a rate of 1:54. Pan. 479A, B and C, Tab. 89, is taken from the pass. To the S. 22° E. was pointed out a pass, *Shage-la*, probably situated in the water-parting *Himalaya Range*, or at any rate, south of the *Tsangpo*. In the same direction the extensive valley of the latter river was visible at no great distance. *Sukba-la*, on the other hand, was situated in a ramification of the *Chomo-uchong* to the S. W. The *Chomo-uchong* itself was seen to the N. 37° E. From *Camp CCCXCVII*, Pan. 480, Tab. 89, gives only a view up into the valley of *Rong-chu*, by which we had travelled down a year before.

On *May 1st*, the journey proceeded 4.4 km. N. N. W. to *Lamlung-la* at an altitude of 5,118 m., a rise of 338 m. at a rate of 1:13. On the northern side we had 3.3 km. N. W. to *Camp CCCXCVII*, 4,982 m. high, a rise of 136 m. and a rate of 1:24. From *Lamlung-la*, Pan. 482, Tab. 90, shows a new view of the *Chomo-uchong* with its highest peak to the S. 64° E.; Pan. 483, Tab. 90, from the same pass, gives a view of a part of the *Kanchung-gangri* to the N. N. W. The peak to the N. 37° W. is, no doubt, the same as the one to the N. 1° E. from *Takbur-la*, as seen on Pan. 210A, Tab. 38.

On *May 4th*, our way proceeds 6.3 km. north to *Gara-la*, 5,033 m. high, a rise of 51 m. at a rate of 1:123. On the northern side of the pass it is 2.3 km. to *Camp CCCXCVIII*, *Tangma-ni*, where the altitude is 4,922 m., a fall of 111 m. at a rate of 1:21.

On *May 6th*, we travelled 10 km. N. E. and W. N. W. to the pass, *Shalung-la*, at an altitude of 5,320 m. being a rise of 398 m. at a rate of 1:25. From the

pass we had 1.6 km. to *Camp CCCXCIX, Gyägon*, at an altitude of 5,114 m., being a fall of 206 m. at a rate of 1:8.

On *May 7th*, we had 6 km. N. E. to the pass, *Gyägon-la*, 5,490 m. high, being a rise of 376 m. at a rate of 1:16. On the northern side we had 8.4 km. north to *Camp CCCC*, where the altitude was 5,333 m., or a fall of 157 m. and a rate of 1:53.5. The southern side is thus more than three times as steep as the northern side. In this pass the *Lombo Range* is crossed; its western continuation is called *Kanchung-gangri*, like the range north of it. From *Camp CCCC* Pan. 484A, Tab. 90, is drawn, embracing moderate mountains and no very high peaks.

On *May 8th*, the road goes 4.4 km. N. N. W. to *Damche-la*, 5,418 m. high, being a rise of 85 m. at a rate of 1:52. On the northern side the distance to *Camp CCCCC, Lapchung*, at an altitude of 5,193 m., was 10.7 km. to the N. N. W. and N. N. E., the fall being 225 m. at a rate of 1:47.5. Here the northern slope was somewhat steeper than the southern.

From *Camp CCCCC* the important panorama, 488A and B, Tab. 91, was drawn, showing two high peaks of *Kanchung-gangri* to the S. 30° W. and S. 39° W., obviously being the same as those to the N. 37° W. on Pan. 483, Tab. 90, and to the N. 1° E. on Pan. 210A, Tab. 38. In Vol. III, p. 308, there is a watercolour sketch of the same *Kanchung-gangri* peaks. From the same camp the mountainous regions *Luma-nakchen-nakchung*, *Salung-nakchung* and *Salung-nakchen* and the valley and pass of *Gyandar-ngundor* are to the W. S. W., W. N. W. and N. W. In the foreground is *Lapchung-tso*, the lake from which *Chaktak-tsangpo* comes.

On *May 9th*, we travelled 15.2 km. north, ascending to an altitude of 5,245 m. at *Camp CCCCII, Sang-bertik*; a rise of 52 m. and a rate of 1:292. From this camp Pan. 485A, B and C, Tab. 90, was taken all around the horizon.<sup>1</sup> To the N. 61° W. it shows the flat threshold of *Dicha-la*, obviously situated in the latitudinal valley between the *Lapchung* and the *Kanchung Ranges*. To the N. N. E. is *Sangmo-bertik-la* with the continental water-parting. To the S. 62° E. the *Nakbo-gongrong-gangri* with its snowy peaks is visible, being a part of or a ramification from the *Kanchung-gangri*. To the S. 13° E. the *Chomo-uchong* group is still visible in an opening between nearer hills. A part of the *Kanchung-gangri Range* is now visible from the northern side to the S. S. E., S. W. and west. To the S. 14° W. we see the same peak as the one to the S. 30° W. on Pan. 488A, Tab. 91.

On *May 11th*, we travelled 12.2 km. N. N. E. to *Camp CCCCIII, Sangmo-bertik*, where the altitude is 5,586 m. The rise is 341 m. and the rate 1:35.8.

The next day, *May 12th*, we had to cross the continental water-parting. We had 4.8 km. up to *Sangmo-bertik-la*, situated in the *Lapchung Range* at an altitude

<sup>1</sup> Cp. Vol. III, p. 310.

of 5,820 m. The rise is, therefore, 234 m. and the rate, 1:20.5. On the northern side we had 9.1 km. to *Camp CCCCIV* at a height of 5,435 m., a fall of 385 m. at a rate of 1:23.6. The direction is N. N. E. and north. Pan. 486, Tab. 90, is a view to the north from the pass. Pan. 487, Tab. 90, is a view to the S. S. E. In the other direction the camp was enclosed by hills in the immediate vicinity.

On *May 13th*, the slope down to the north in the valley of *Sangmo-yung* was more gradual, or 1:50.3 the distance being 15.8 km. *Camp CCCCIV* had an altitude of 5,121 m., and the descent was 314 m. Pan. 489, Tab. 91, is a little view to the N. N. E. from the camp, and Pan. 490, Tab. 91, shows the view to the south and S. S. W. from the same place.

The fall of the ground becomes still more gradual the next day, *May 14th*, or 1:88. Here we marched 13.8 km. N. N. E. to *Camp CCCCVI*, descending 157 m. or to an altitude of 4,964 m. The view to the N. N. E. and N. E. and to the S. S. E. and S. S. W. from this camp is represented on Pan. 491 and 492, Tab. 91.

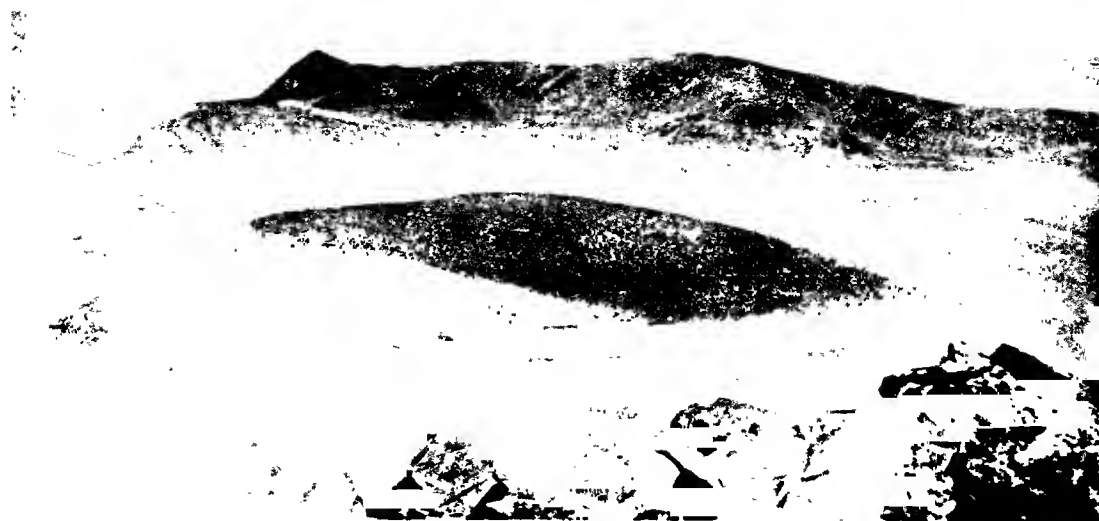
On *May 15th*, the descent decreased again, being only 1:109. The distance was 19.7 km. N. E. to *Camp CCCCVII*, *Kangmar*, with an altitude of 4,783 m., the fall being thus 181 m.

On *May 17th*, our march continued N. E. for 18.6 km. to *Camp CCCCVIII*, *Daksha-lungpa*, at an altitude of 5,150 m.; the rise here being 367 m. or as 1:51. From this camp views were taken to the S. E. and S. W., as shown on Pan. 494 and 495, Tab. 92.

On *May 18th*, we travelled 14 km., first E. S. E. to the little pass, *Dongchen-la*, 5,113 m. high, then N. N. E. to *Camp CCCCIX*, at an altitude of 4,714 m., being a descent of 436 m., and at a rate of 1:32. From the camp Pan. 493A and B, Tab. 91, was sketched. It shows to the N. W., north and N. E., a range which may be regarded as a ramification from the range crossed in the *Donchen-la*, and which, in the absence of a better name, I have called *Teri-nam Range*. The latter range is to be seen to the south on the same panorama.

On *May 19th*, we turned north-westwards, marching 7.4 km. to *Teta-la*, 4,958 m. high, an ascent of 244 m. at a rate of 1:30.3. On the other side we descended 189 m. in 5 km. to *Camp CCCCX*, *Hlakelung*, where the altitude is 4,769 m. the rate being 1:26.5. One kilometer north of *Teta-la* I ascended the hill, *Pang-shachen*, 5,173 m. high, from where Pan. 496A, B and C, Tab. 92, was sketched. This panorama gives a good idea of the *Teri-nam-tso* and the mountains surrounding it. I have described the view in Vol. III, p. 312. To the N. 31° W. the *Shakangsham* is in sight, and to the east and E. S. E. the meridional range of *Targo-gangri*. The desiccation lines and old beach-lines are visible all around the lake.

On the last day of this section, *May 24th*, we travelled W. N. W. for 15.3 km. down to the immediate neighbourhood of the lake. The first 6.5 km. take us to



DAKBA-TSO ON THE SOUTHERN SIDE OF TERI-NAM-TSO. LOOKING NORTH FROM PANG-SHACHEN NEAR CAMP 410.



THE TERI-NAM-TSO. LOOKING N  $25^{\circ}$  W FROM PANG-SHACHEN  
NEAR CAMP 410.







CROSSING THE SOMA-TSANGPO AND THE BUPTSANG-TSANGPO.





TIBETANS OF TERI-NAM-TSO.





RIVER-CROSSINGS IN THE TRANSHIMALAYA (BUPTSANG-TSANGPO AND SOMA-TSANGPO).



the secondary pass of *Lamlung-la*, being 5,145 m. high. The difference in altitude thus is 376 m. and the rise is at a rate of 1:17.3. On the western side we had 8.8 km. to *Camp CCCCXI, Kibuk-hle*, at an altitude of 4,689 m., or 456 m. below the pass, the descent being as 1:19.3. From a hill in the region, *Tashi-Tsering*, a place obviously called after the name of a nomad here grazing his flocks, Pan. 497<sup>A</sup> and B, Tab. 92, was drawn. Here we again obtain a good view of the lake. The *Shakangsham* is in sight to the N. 26° W., and the *Targo-gangri* to the E. S. E. *Domar* is the little ridge on the southern shore which was also to be seen on Pan. 496 B, Tab. 92. Its appearance from *Hlakelung* is shown on Pan. 498, Tab. 93, where the beach-lines along its base are readily visible. The same return again along the base of the hill, *Tashi-Tsering*, as seen on Pan. 499, Tab. 93.

According to this calculation, the whole road has a length of 225.2 km. On the construction map we found 229.3.

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## CHAPTER XXXIV.

### ALONG THE CENTRAL LAKES.

It now only remains to examine the distances and plastic forms of the marches along the *Central Lakes*, situated at the northern base of the *Transhimalayan System*, and finally, to say a few words of the crossing of the same system from *Nganglaring-tso* to *Manasarovar*, which from a chronological point of view, was the eighth one.

We begin from *Kibuk-hle*, *Camp CCCCXI*, from where we travelled 12.1 km. to the N. W. along the S. W. shore of the *Teri-nam-tso* to *Camp CCCCXII*, *Tertsi*, situated at the western shore. The altitude of the lake has been calculated at 4,679 m. Looking N. 82° E. from this camp, Pan. 500, Tab. 93, one hardly sees any mountains at the eastern side of the lake, which is situated in a latitudinal valley between mountain ranges. To the E. S. E. are the two hills, *Techen* and *Techung*. To the S. 1° E. is Mount *Migot*. To the N. 70° W. is the prolongation of the latitudinal valley. To the north and N. E. we again return to the lake, with the northern mountains in its background.

The march of *May 26th* is directed to the N. W. for 22 km. to *Camp CCCCXIII*, *Mendong-gompa*, at an altitude of 4,693 m., a rise of only 14 m. and a rate of 1:1,571, showing that the ground in the latitudinal valley to the west of the lake is practically level. It therefore seems likely that the lake itself is rather shallow. Pan. 501A and B, Tab. 93, is a sketch of the mountains surrounding the camp. To the S. 66° E. is the lake and the promontories at its southern shore. To the south and S. S. W., along the base of the hills, old beach-lines are strongly modelled in the slopes appearing as horizontal parallel lines. To the S. 62° W. is the entrance to the valley of the *Soma-tsangpo*, the mountain passage of which is visible to the S. 29° W. To the N. 89° W. is the flat hill, *Nara*, N. 60° W. the plain *Nevem*, being a part of the latitudinal valley, N. 46° W., quite near, the monastery of *Mendong*, N. 25° W. to N. 2° E. the hills, *Yage-tarna*, *Yage-lungpa* and *Mage*, all belonging to the range bordering the latitudinal valley to the north. *Togmar* and *Topchen-nakta* are parts of the same range to the N. E. Finally, to the N. 81° E., are hills of the same range, standing on the northern shore of *Teri-nam-tso*.

VOL IV

S 70° E THE SHURU RANGE

S 64° E

S 43° E

THE NAKBO-SANGRONG-SATK RANGE

S 20° E

THE LARCHUNG TSGU



VIEW OF THE TRANSHIMALAYAN RANGES AS SEEN FROM THE SECOND PASS, MAY 30, 1939, IN THE FOREGROUND LAKE KARONG TSGU

S 6° W THE LARCHUNG-GANGRI RANGE

S 10° W

S 3° E

S 50° E

THE LUNARONG TSGU



THE GANGRI TSGU



On *May 28th*, we travelled W. S. W. and S. S. W. for 12.7 km. up the valley of the *Soma-tsangpo* to *Camp CCCCXIV, Sok-yung*, where the altitude is 4,714 m., or 21 m. above the previous camp, being a rate of 1:605. Pan. 502A and B, Tab. 94, does not contain any considerable mountains. Some of those surrounding the camp are called *Meri* or *Menri*, *Nagrang-* or *Nagräng-ri* and *Rabalu*, belonging to the *Teri-nam Range*, which here is cut through by the *Soma-tsangpo*.

On *May 29th*, we marched 17 km. W. S. W. on rising ground to *Camp CCCCXV, Goa-lung*, where the altitude is 5,022 m. The ascent is 308 m. and the rate, 1:55.

On *May 30th*, our march continued westward, first 6.2 km. to *Goa-la*, with an altitude of 5,298 m., being a rise of 276 m. and a rate of 1:22.4. From the pass we had 9.4 km. to *Camp CCCCXVI, Changsa-lungpa*, at an altitude of 5,035 m., the fall being 263 m. and the rate 1:36. Pan. 503, Tab. 94, was drawn from *Goa-la* to the S. E., south and S. W. and it gives, again, the impression of a stormy sea of waves. From a hill 3.3 km. west of *Goa-la*, Pan. 505A and B, Tab. 94, was drawn. This panorama is interesting as it contains the newly-discovered lake *Karong-tso* of very irregular form, with islands and rocky promontories, and well hidden in a labyrinth of ranges, ridges and hills. The whole next day's journey we had the lake south of our route, though it was in sight only occasionally. A watercolour sketch gives an idea of this lake. Pan. 504, Tab. 94, finally, is taken from *Camp Changsa-lungpa*.

On *June 1st*, we continued 13.7 km. west, leaving behind us the mountain mass, the highest part of which was *Goa-la*. *Camp CCCCXVII, Tamo-yakshung*, was at an altitude of 4,725 m., the descent thus being 310 m., and the rate, 1:44. Pan. 506, Tab. 95, is drawn from this camp.

On *June 2nd*, our road goes west and S. W. for 20.6 km. to *Camp CCCCXVIII, Saglam-lungpa*, at an altitude of 4,786 m. The rise is, therefore, 61 m., and the rate, 1:338. Pan. 508A and B, Tab. 95, taken from the new camp, shows moderate mountains in the vicinity, and no distant peaks. To the S. 50° E. is the valley of *Kero*.

The next day we had 11.7 km. W. S. W. to *Camp CCCCXIX, Gole-tata*, at an altitude of 4,788 m., only 2 m. above *Saglam-lungpa*. The little threshold, *Merke-shung*, on the road has an altitude of only 4,815 m. On Pan. 507A and B, Tab. 95, we find to the S. 17° W. the district, *Bongba-bupto*, entered. To the S. W. and W. S. W. are parts of the mighty *Lunkar Range*, a part of which, to the S. 80° W., has the name *Shangchung-gangri*. The *Tarok-tso* was pointed out as situated to the N. 65° W., though still hidden by mountains. To the N. 10° E. is shown a pass called *Shalung-la*. To the N. 47° E. is a hill, *Gyam-ri*. To the S. 26° E. is a Mount *Risema*, only a few kilometers distant. To the S. 13° E. is another mountain called *Serte-rigy*.

On *June 4th*, our road proceeds westwards 16.4 km. to *Camp CCCCXX*, *Kebyang*, at an altitude of 4,776 m. The fall is thus only 12 m. and the rate imperceptible or as 1:1,367. *Kebyang* is situated in the valley of the *Buptsang-tsangpo*. Pan. 509A and B, Tab. 96, also shows very open land to the S. S. E., being the continuation of the very gradually rising valley of the river. To the S. W. and W. S. W. are again parts of the *Lunkar Range*.

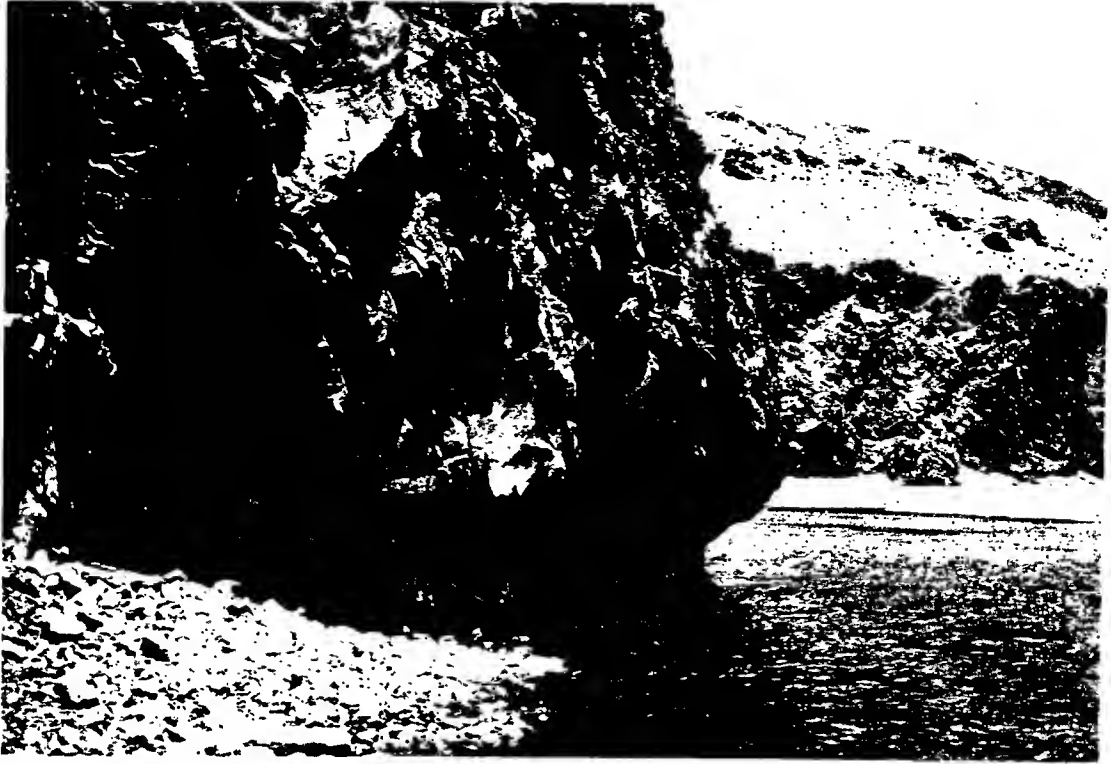
Following the *Buptsang-tsangpo* downwards, we covered, on *June 5th*, 15.5 km. to the N. W., descending to an altitude of 4,704 m. at *Camp CCCCXXI*, *Mabiye-tangsang-angmo*, being a fall of 72 m. and a rate of 1:215. From the last-mentioned camp, Pan. 510A and B, Tab. 96, was drawn. It shows to the S. 33° E., a side valley, called *Nate*, to the south the group *Shangchung-gangri*, to the S. 20° W. the *Rabchi* valley, to the S. 78° W. the *Malung-gangri* and to the right or north of it, Mount *Shangra*, all belonging to the *Lunkar Range*. To the N. W. is the valley of the *Buptsang-tsangpo* going down to the *Tarok-tso*.

On *June 6th*, our road continues down the river for 11.3 km. to the N. W. to *Camp CCCCXXII*, *Tuta*, at an altitude of 4,664 m. The fall is, therefore, 40 m. and the rate 1:282. Pan. 513, Tab. 97, was drawn from the last camp. The peak *Nalung* which it shows to the S. 15° E., is probably the same as the one previously called *Malung*. Considerable erosion terraces at the sides of the *Buptsang* River are seen on the panorama.

On *June 7th*, we travelled 16 km. N. W. to *Camp CCCCXXIII*, *Tarok-shung*, at an altitude of 4,632 m., being a descent of 32 m. and a rate of 1:500. From *Tarok-shung* we have to consider Pan. 511A, B, and C, Tab. 96. To the S. S. E. the *Nara* valley, *Malung-gangri* and *Shangra* are again visible. To the S. S. W. is *Lungnak-gangri-tasor*, to the S. W. the *Lungnak* valley, and S. 56° W., *Gya-buk-ri*. To the N. 73° W. is Mount *Lungkar-buk*. In the foreground to the north is *Tarok-tso*, and beyond it, in the same direction, the *Tabie-tsaka* which obviously, to its north, is bordered by a considerable range. Between the two lakes is a neck of land with low hills, readily visible on the panorama. To the N. 81° E. is *Gya-gong-ri*, a part of the range bordering the right side of the valley of the *Buptsang-tsangpo*. The panorama shows that other parts of the same range also have their particular names.

On *June 9th*, we marched N. W. to *Lunkar-gompa* at the entrance of the *Lunkar* valley and up S. W. in the latter for 12 km. to *Camp CCCCXXIV*, where the altitude was 4,787 m. The rise is, therefore, 155 m., and the rate 1:77. Pan. 512A and B, and Pan. 514<sup>1</sup>, Tab. 97, is taken from *Lunkar-gompa* on its hill, where

<sup>1</sup> By a mistake Pan. 513 has come in between two sections of Pan. 512. Pan. 514 is the immediate continuation of 512B.



THE BUPTSANG-TSANGPO AT TUTA. (CP. SKETCH VOL. III, P. 352.)





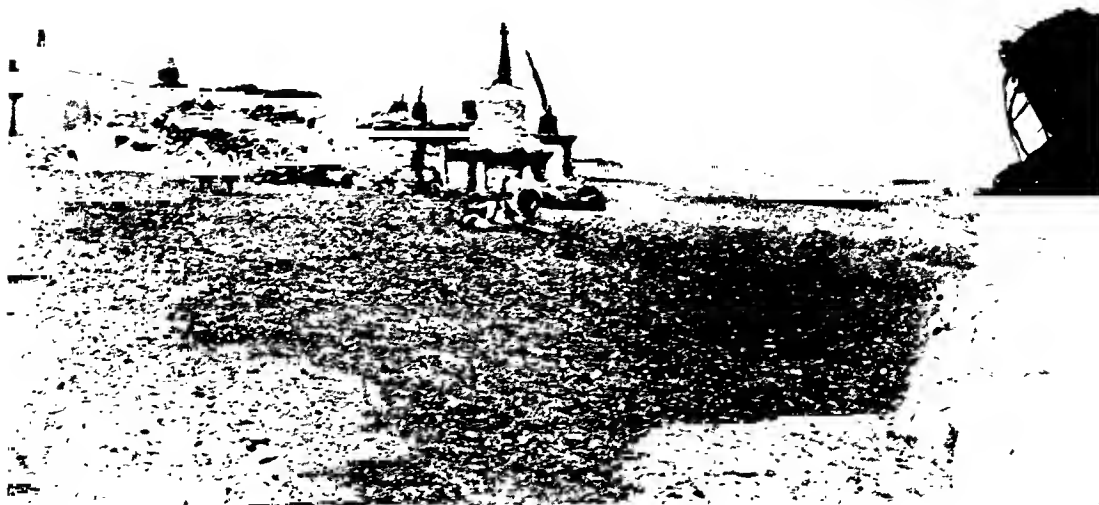
VIEWS FROM THE HILL OF LUNKAR-GOMPA. IN THE  
BACKGROUND BUPTSANG-TSANGPO AND TAROK-TSO.







NATIVES FROM THE VILLAGE OF LUNKAR.



CHORTENS BELOW LUNKAR-GOMPA.





LUNKAR-GOMPA AND ITS NEIGHBOURHOOD. N:R 6 IS TAKEN FROM  
THE VERY SOURCE OF THE INDUS, LOOKING S 70° E.



the altitude is 4,756 m.; in the valley below, 4,692 m. Here we have a new view of the *Tarok-tso*, and to the north or N. N. E. the neck of land between the two lakes. To the east and S. E. is the range to the right of the *Buptsang* valley. To the S. 55° E. is *Tengi-niguk*, belonging to the latter range. *Malung-gangri* is still visible. In the foreground, to the S. E. is *Lunkar-gompa* itself. To the N. 27° E. there is one or perhaps two islands in the *Tarok-tso* near its northern shore.

On *June 10th*, we had an interesting march up the *Lunkar* valley W. S. W. and S. W. for 9.7 km. to *Lunkar-la*, 5,570 m. high. The rise from *Camp CCCCXXIV* was, therefore, no less than 783 m., and the rate 1:12.4. On the other side we had 3.4 km. S. W. and W. S. W. to *Camp CCCCXXV*, *Goang-shung*, 5,349 m. high, a fall of 221 m. and a rate of 1:15.4. Here the northern slope is thus steeper than the southern. From *Lunkar-la* Pan. 515<sup>A</sup> and B, Tab. 97, was sketched. Nearly the whole of *Tarok-tso*, except its eastern part, was to be seen, and its islands in its northern part. A part of the salt lake of *Tabie-tsaka* could also be seen and the neck of land with its hills. To the N. 49° E. is *Shakangsham*, beautifully rising above everything else. From here one gets the impression that the *Shakangsham* belongs to a range. The snowy Mount *Amlung* to the N. 82° E., is difficult to place. *Charko-ri*, S. 79° E., is only a few kilometers distant. The mountains called *Mela-gangri* on Pan. 515<sup>B</sup>, Tab. 97, visible to the S. 49° W. and S. 88° W., are certainly parts of the *Surla Range* and the *Bongba-yeke-gangri*. The name *Mela-gangri* was given us by our guides on the *Lungkar-la*.

On *June 11th*, we covered 14.5 km. S. W. to *Camp CCCCXXVI*, *Gyänor-tsangpo*, being at an altitude of 5,187 m. or 162 m. below the previous camp, the rate of fall thus being 1:89. Pan. 516, Tab. 97, taken from the last camp, shows a large part of the mighty *Bongba-yeke-gangri Range* with its covering of eternal snow. To the W. S. W. the *Poru-tso* is situated, though still hidden by the low hills in the foreground. To the S. 53° E. is Mount *Kapta*, as seen from the same camp, Pan. 517, Tab. 97.

*Camp CCCCXXVII*, *Tokya*, was situated 12.7 km. S. W. of the preceding camp. The first 10 km. took us to the *Chuka-la*, 5,320 m. high, a rise of 133 m. at a rate of 1:75. From the pass to the camp we had 2.7 km. and a descent of only 13 m., as the latter had an altitude of 5,307 m.; the rate is, therefore, 1:208. Pan. 518, Tab. 97, shows, from S. 52° W. to N. 58° W., a mighty range, the one we have mentioned above. We have here to deal with *one* very considerable and nearly meridional range, the northern section of which is situated east of *Nganglaring-tso* and *Shovo-tso*, whilst its middle part is west of *Poru-tso*, and its southern section to the east of the *Pedang Range*. On my route this range, *Surla*, is crossed in only one pass, the *Surla-kemi-la*. The orographical importance of the range *Bongba-yeke-gangri* is, on the other hand, not quite clear. It should certainly not be

regarded as a special range parallel with and east of the *Surla Range*. It may be a ramification from the latter. But the most likely hypothesis is that there is only one broad range, and that the *Bongba-yeke* simply is the eastern front of the *Surla Range*. The *Bongba-yeke* should, therefore, be regarded as a portion of the *Surla*. Such questions as this can only be solved by detailed exploration.

On *June 13th*, our march goes W. S. W. for 10.1 km. to *Camp CCCCXYVIII*, *Shaktik*, where the altitude is 5,202 m., or 105 m. below the previous camp, being a rate of 1:96. From this camp Pan. 520A and B, Tab. 98, was sketched, giving a good view of the range of *Bongba-yeke-gangri*, or simply *Yeke-gangri*, to the N. N. W., N. W. and west with snowfields and small glaciers. To the N. E. are moderate hills standing east of *Poru-tso*. The old beach-lines are partly visible, the highest being 108 m. above the lake. Pan. 519, Tab. 98, is taken from the same place. It shows to the S. S. E. well-developed beach-lines, and to the S. W. and W. S. W., the southern continuation of the *Surla Range*.

The next day we travelled 8.9 km. W. S. W., crossing the plain south of the lake and gradually ascending into the broad mouth of the valley of *Surla* to *Camp CCCCXXIX*, where the height was 5,215 m. The ascent is, therefore, only 13 m. and the rate 1:685. Pan. 521 and 522A and B, Tab. 98, together form an uninterrupted view of the whole horizon. It begins with the comparatively low mountains situated between the *Kapta* and *Surla Ranges*. To the S. 10° E. is *Men-la*, a pass on the continental water-parting. To the S. S. W., S. W., west, N. W., and to N. 11° E. is again the *Yeke-gangri* or northern *Surla Range*. To the N. 35° E. is a pass called *Tsalam-la*.

On *June 16th*, our road proceeds W. N. W. for 14.6 km. up the *Surla* valley to *Camp CCCCXXX*, *Surle-pu*, with an altitude of 5,525 m., an ascent of 310 m. and a rate of 1:47.

The high pass, *Surla-kemi-la*, which is a water-parting between the *Poru-tso* and *Shovo-tso*, was crossed on *June 17th*. The direction is N. W. and north. From *Camp CCCCXXX* we had 3.7 km. to the pass, 5,832 m. high, a rise of 307 m. and a rate of 1:12. The descent to *Camp CCCCXXXI*, *Dung-lung*, at 5,443 m., was 9.4 km., a fall of 389 m. at a rate of 1:24, or only half as steep. From a point a little to the south of the pass the panorama p. 358, Vol. III, was made in water-colours. It shows some of the glaciers of the *Surla Range*. The pass is also simply called *Sur-la*.

On *June 18th*, we continued down 14.6 km. N. W. to *Camp CCCCXXXII*, *Pedang-chu*, at an altitude of 5,069 m., a descent of 374 m. at a rate of 1:39. From a point 4 km. S. 54° E. of *Camp CCCCXXXII*, Pan. 523, Tab. 98, was drawn, showing portions of the *Surla Range* to the N. N. E. and N. E. Pan. 524, Tab. 99, is its immediate continuation. To the W. S. W., west and W. N. W. it shows portions of

the *Pedang Range*. Pan. 527A, B and C, Tab. 99, is taken from *Camp CCCCXXXII*. It goes all around the horizon, showing the *Surla Range* to the east and the *Pedang Range* to the west.

On *June 19th*, our road goes along the *Pedang-chu* 22.1 km. N. N. E. to *Camp CCCCXXXIII*, *Tsole-shung*, at an altitude of 4,889 m., a fall of 180 m. at a rate of 1:123. From this Camp we have to note Pan. 526A and B, Tab. 99, being a good view of the western side of the *Surla Range* with some of its comparatively mighty snow-peaks, some of them certainly giving birth to small glaciers.

The next travelling day, *June 21st*, we travelled north to *Shovo-tso*, first 14.4 km. to the pass, *Abuk-la*, 5,084 m. high, a rise of 195 m. at a rate of 1:74. The descent, 6.6 km. to *Camp CCCCXXXIV* on the lake, at an altitude of 4,784 m., was 300 m. and the rate 1:22. Pan. 529, Tab. 100, is taken from *Abuk-la*. It shows the lake *Shovo-tso* in the foreground, and to the north of it considerable mountains, which also are situated to the N. E. of *Nganglaring-tso*. To the N. 30° E. is the important pass *Ka-la*, and to the N. 55° E. another pass called *Tokchen-la*. Pan. 528, Tab. 99, is taken from *Camp CCCCXXXIV* on the shore of *Shovo-tso*, showing the old beach-lines and the valley up to *Ka-la*.

Leaving the lake on *June 22nd*, we marched N. W. for 12 km. to the pass *Tela-mata-la*, 5,160 m. high, or an ascent of 376 m. and a rate of 1:32. On the northern side we had 4.1 km. to *Camp CCCCXXXV*, *Sermo-kunglung*, 5,041 m. high, or a descent of 119 m. at a rate of 1:34. From *Tela-* or *Tele-mata-la* Pan. 530, Tab. 100, was drawn to the S. E. showing a part of the basin of *Shovo-tso* and a portion of the *Surla Range*. Pan. 532, Tab. 100, was drawn to the W. S. W. and W. N. W. from the same pass, showing comparatively moderate mountains.

On *June 23rd*, our journey goes 3.4 km. N. N. W. to *Tayep-parva-la*, 5,452 m. high, a rise of 411 m. at a rate of 1:8.3. Another 3 km. in the same direction take us to *Camp CCCCXXXVI*, where the altitude is 5,119 m., a fall of 333 m. at a rate of 1:9. Both sides of this pass are, therefore, rather steep. Pan. 531, Tab. 100, is a view from *Tayep-parva-la*. The snowy range seen on it to the S. E. and S. S. E. is the *Surla Range*. Pan. 534, Tab. 100, is taken from *Camp CCCCXXXVI*, and gives us the first view of *Nganglaring-tso* along to the N. W. When travelling along only one shore of a lake it is, of course, impossible to get an idea of the whole lake. The form I have given to *Nganglaring-tso* on Pl. 23 will in the future be very much changed. The first surveyor has, however, to make the best of the material he is able to collect. To me and my assistants the panoramas, as *e. g.* No. 534, Tab. 100, have been a great help. On the other hand, the form of the large island with its four promontories seems unlikely. A future detailed mapping of this lake will show how insufficient my observations were.



We reached the shore of *Nganglaring-tso*, June 24th, the distance down to the lake, N. W., being 3 km., and then westwards 10 km. along the shore. The slope down is very steep, for the lake is at an altitude of 4,746 m., or a descent of 373 m. and a rate of 1:8. *Camp CCCCXXXVII*, *Kungma-dumly*, is at 4,748 m. A hill near the shore, N. N. W. of *Tayep-parva*, has an altitude of 4,938 m. From this hill Pan. 533A and B, Tab. 100, was drawn. It shows from the N. W. to N. N. E. a new perspective of the large island, and to the N. E. and E. N. E. considerable mountains which must be regarded as the northern continuation of the *Surla Range*. To the east is pointed out the valley of *Ka-la*. Nearly the same landscape, though in another perspective, is shown on Pan. 535, Tab. 100.

On June 25th, we had to cross a ridge which projects to the southern shore. We had to climb 530 m. in a distance of 7.1 km. to the W. S. W. to the pass *Pu-karu-la*, where the altitude is 5,278 m.; the rate is, therefore, 1:13. On the western side we again descended 294 m. in 2.8 km. to the S. W. to *Pebuk*, situated at 4,984 m. Here the slope is as 1:9.5. Pan. 536A, B and C, Tab. 101, taken from *Pu-karu-la*, is of very great interest. It unrolls, namely, considerable portions of all the three high *Transhimalayan Ranges Surla, Pedang and Lavar*, the snowy crests and peaks of which are visible to the S. E., south and S. W. To the N. 82° W. it shows the course of the *Sumdang-tsangpo* just above its entrance in the lake. To the N. W., north and N. N. E. it shows another view of the *Nganglaring-tso* with its islands and promontories. To the N. E. and E. N. E. we again meet a part of the *Surla Range*.

On June 26th, we travelled 11.9 km. W. N. W. to *Camp CCCCXXXIX* on the *Sumdang-tsangpo*, at an altitude of 4,758 m., a descent of 226 m., and a rate of fall as 1:53.

The whole road to *Camp CCCCXXXIX*, from where the last crossing begins, is thus 398.6 km. in length.

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LOOKING N. W. FROM THE SURLA PASS.



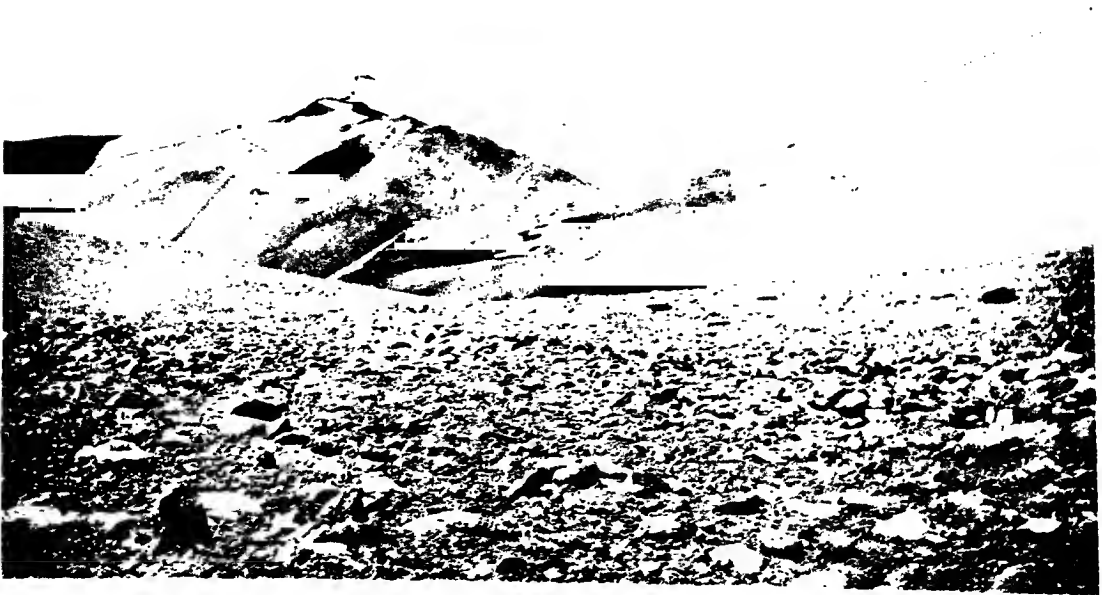
THE SURLA GLACIERS FROM A POINT SOUTH OF THE SURLA (SURLA-KEMI-LA) PASS. THE PYRAMIDAL SNOW PEAK IS SEEN TO THE S  $31^{\circ}$  W. (CP. THE WATER COLOUR SKETCH VOL. III, P. 358.)





IN THE SURLA MOUNTAINS, TRANSHIMALAYA.





THE SURLA-KEMI-LA IN THE SURLA MOUNTAINS,  
TRANSHIMALAYA.





THE GOVERNOR OF CHOKCHU LEAVING SELIPUK.



THE PLAIN OF SELIPUK LOOKING N 60° W.





IV

N 10° W

N 5°

THE

THE

THE



LAKE NCA AND MOUNTAINS AT THE REDDISH HILLS - 1000 FEET - 1000

THE

THE

THE



LAKE NCA AND MOUNTAINS FROM CAMP 407



## CHAPTER XXXV.

### FROM NGANGLARING-TSO TO TOKCHEN.

Only the last crossing of the *Transhimalaya* remains to be considered. It begins from *Camp CCCCXXXIX* and comes to an end at the upper *Tokchen*, *Camp CCCCLI*. The general description of this road was given in Vol. III, p. 324 *et seq.*

The first day's journey, along the southern bank of *Sumdang-tsangpo*, *June 27th*, took us 15 km. W. S. W. to *Camp CCCCXL*, *Selipuk-gompa*, where the altitude is 4,776 m.; the rise is therefore, 18 m., and the rate 1:833. Pan. 537A, B and C, Tab. 101, is drawn from a point below the monastery. It shows to the N. E. and N. 80° E. a part of the northern *Surla Range*, situated N. E. of *Nganglaring-tso*. To the E. S. E. and S. E. is the *Pedang Range*. To the S. S. E., south, S. W. and W. S. W. is the range, *Lavar-gangri*. To the W. N. W., north and N. E. is a ridge of small hills bordering the *Sumdang-tsangpo* on the north.

On *June 30th*, the road proceeds S. W. and S. S. W. for 8.1 km. to *Camp CCCCXLI*, at an altitude of 4,785 m. The rise is 9 m. only, and the rate 1:900. The plain south of *Nganglaring-tso* is thus very level. Pan. 538A, B and C, Tab. 102, is from *Rartse*. To the E. S. E. and S. E. it again shows the *Pedang Range*, after which follows the *Lavar Range* the whole way around to the west. To the W. N. W., N. W. and north, moderate hills are visible in the region of *Yumba-matsen*, where the fourth crossing came to an end. From N. E. to east we again see a part of the northern *Surla Range*.

On *July 1st*, we travelled 22.8 km. S. S. W. to *Camp CCCCXLII*, *Kyangyang*, at an altitude of 4,977 m., a rise of 192 m., at a rate of 1:119. On *July 5th*, we travelled W. S. W. and W. N. W. for 5.7 km. to *Kyangyang-la*, with an altitude of 5,157 m., the rise here being 180 m. and the rate 1:31.7. On the western side, 3.8 km. took us to *Camp CCCCXLIII*, *Lavar-demar*, 5,048 m. high, a fall of 109 m. at a rate of 1:35. Pan. 540, Tab. 102, from the pass, shows to the S. 23° E. a mountainous region called *Sumdang-changma*, probably situated between the *Lavar* and the *Ding-la Ranges*. The snowy peaks of *Pang-nagrong* to the S. 10° E. obviously

belong to the last-mentioned range. The mountains to the S. S. W., S. W. and W. S. W., amongst them the *Gangchen* and *Gangchung*, seem to form a special range east of the north-western part of the *Ding-la Range*.

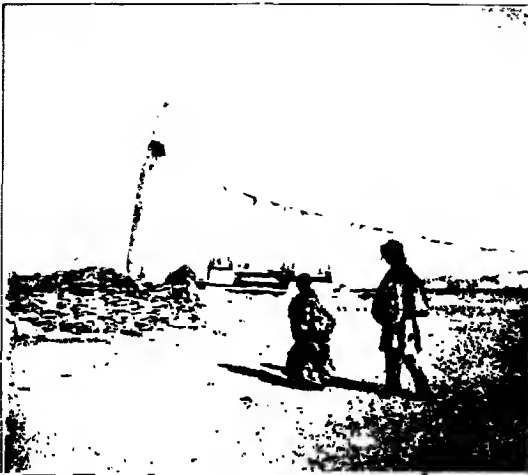
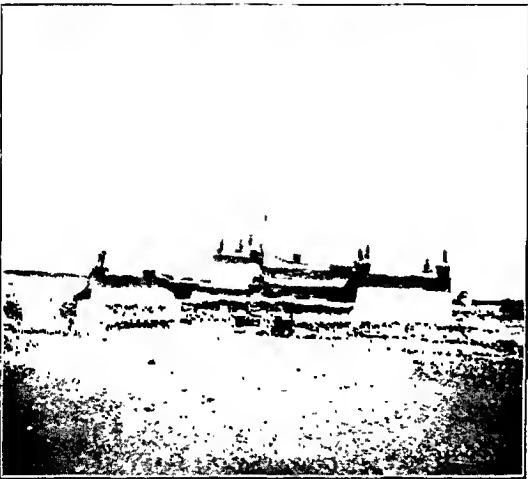
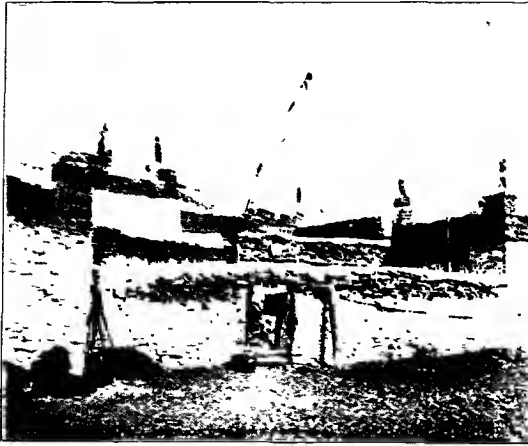
On *July 6th*, we travelled 13.6 km. W. N. W. down the *Lavar-tsangpo* to *Camp CCCCXLIV, Kelle*, at an altitude of 4,949 m., the fall thus being 99 m. and the rate 1:137. To the S. W. and N. W. from here, Pan. 539, Tab. 102, shows some conical peaks of moderate elevation.

The next day our march continued westwards for 13 km. to *Camp CCCCXLV*, in the upper valley of the *Aong-tsangpo*, and at an altitude of 5,196 m., the rise thus being 247 m. at a rate of 1:53. From a point 4.5 km. east of the camp, Pan. 541, Tab. 103, was drawn. To the N. 81° W., N. 60° W., N. 44° W., N. 33° W., N. 23° W. and N. 14° W. it shows irregular ridges and peaks of no very considerable elevation, amongst them the *Ra-taon*, the *Lungnak*, the *Tokchung* and the *Tokmarbo*, the latter in the direction of *Damraptso*, to which the *Lavar-tsangpo* and the *Aong-tsangpo* stream. These mountains and peaks are situated between my route to and beyond the source of the *Indus*, and the route dealt with at present. The intermediate region, which has been crossed by Nain-Sing, has no high mountains, and those existing seem to be less regular than those described in the central regions of the *Transhimalaya*.

The next day, *July 8th*, we crossed the *Ding-la Range*. The direction is S. S. W. We had 6.6 km. to the pass *Ding-la* or *Chargo-ding-la*, 5,885 m. high. The rise is here 689 m. and the rate 1:9.6. On the southern side we had 9.8 km. to *Camp CCCCXLVI, Luma-nakpo*, at an altitude of 5,138 m., a fall of 747 m., at a rate of 1:13. Pan. 542, Tab. 103, taken from the pass, shows to the S. E., considerable mountains, one of them called *Shiri-marmo*. To the S. S. E., south and S. W. are ridges and moderate peaks belonging to the *Surnge Range*. Due south, *Argok-tso* is visible.

On *July 9th*, we had 12.7 km. S. S. W. to a secondary pass, 5,233 m. high, the rise being 95 m. and the rate 1:134. On the western side we had 4.6 km. W. S. W. to *Camp CCCCXLVII* on the *Surnge-chu* where the altitude is 5,155 m. The fall is there 78 m. and the rate 1:59. From the little threshold, Pan. 543<sup>A</sup> and B, Tab. 103, was drawn, showing to the N. E. and E. N. E. considerable parts of the *Ding-la Range*, and to the S. E. a part of *Argok-tso*. The mountains south of the lake were hidden by clouds and snow.

On *July 10th*, our road proceeded W. S. W. for 22.2 km. up the *Surnge-chu* valley to *Camp CCCCXLVIII, Takche*, where the altitude is 5,281 m., or a rise of 126 m. and a rate of 1:176. The gradient is, therefore, very gradual. On *July 12th*, we even had to go down a few meters to reach the continental water-parting in the *Surnge-la* which is so flat that it is impossible to tell its exact



THE THREE TO THE LEFT ARE VIEWS OF SELIPUK-GOMPA, THE THREE TO THE RIGHT ARE FROM NYANDI-GOMPA AND ITS CHORTEN.



situation. Its altitude was 5,276 m. or 5 m. below *Takche*, which, however, was in the mouth of a side valley and, therefore, somewhat higher than the middle of the pass valley. The distance from *Takche* to the pass was 5.3 km. and the rate of fall 1:1,060. From the pass we had 11.3 km. S. W. to *Camp CCCCXLIX, Surngelungpa*, where the altitude was 4,917 m., a fall of 359 m. at a rate of 1:31.

The next day we continued S. S. W. 5.6 km. to the pass *Yübgo-la*, 5,242 m. high, and probably belonging to the same range as the *Kailas* and the *Pundi*. The ascent is 325 m., and the rate 1:17. On the southern side we had 5 km. S. S. W. to *Camp CCCCL*, where the altitude was 5,027 m., a descent of 215 m. and a rate of 1:23.

The last day, *July 14th*, we marched 13.1 km. S. S. W. to the upper *Tokchen*, *Camp CCCCLI*, where the altitude was 4,654 m. The descent from the *Transhimalaya* was, therefore, 373 m., and the rate of fall 1:35. On the way a little secondary threshold, *Rigong-la*, is passed. From its saddle, 4,972 m. high, the last panorama, 544, Tab. 103, was sketched to the south and S. W. The *Sacred Lake* is not in sight.

The whole distance is, according to the data given above, 178.2 km. Between this and the distance given Vol. III, p. 325, *viz.* 203 km., there is a considerable discrepancy. This is partly due to the fact that in Vol. III the distance is not reckoned from *Camp CCCCXXXIX*, but from the Lake. Taking the latter from the mouth of the *Sumdang-tsangpo*, we get 188 km. The rest is due to corrections of the construction map.

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THE TASHI LAMA.



REMARKS ON THE  
ALTITUDES AND DISTANCES



## CHAPTER XXXVI.

### TABLE OF THE MORPHOLOGICAL ELEMENTS.

The following table contains the absolute altitudes of camps and passes, the rise and fall of the ground, the distances and the rates of the gradients. Only those places have been omitted where the ground may be regarded as nearly horizontal, as for instance between camps situated on the shore of one and the same lake.

The table will give an idea of the morphology of those parts of Tibet which I visited. I will return to it in connection with the discussion of the orography of Tibet which is to be found at the end of Vol. VII.

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1906
Tankse, to . . . . .		5991				August
Muglib . . . . .	15	4140	149		1 : 100	21
Pobrang . . . . .	32	4468	328		1 : 97	22
Lunkar . . . . .	15	5151	683		1 : 22	24
Marsimik-la . . . . .	5	5593	112		1 : 11.3	25
Spanglung . . . . .	8.8	5108		48	1 : 18	25
Pamsal . . . . .	16	5529		579	1 : 27.6	26
Mankook-la . . . . .	13	4839	310		1 : 40.6	28
Kograng-sanspo . . . . .	4.8	4740		99	1 : 48.5	28
Chuta . . . . .	13	4882	142		1 : 91.5	29
Camp I. . . . .	7.3	5170	288		1 : 25.4	31
						September
Chang-lung-yogma . . . . .	10.8	5780	610		1 : 17.7	1
Camp II . . . . .	7.3	5552		228	1 : 32	1
Camp III . . . . .	19.2	5382		170	1 : 113	2
Camp IV . . . . .	17.7	5284		98	1 : 181	3
Camp V . . . . .	22.2	5206		78	1 : 285	4
Threshold . . . . .	11	5367	161		1 : 68	5
Camp VI . . . . .	8.7	5110		257	1 : 34	5
Camp VII. . . . .	30	4953		157	1 : 191	7
Camp VIII . . . . .	12	4916		37	1 : 324	8
Camp IX . . . . .	17.5	4914		2		10
Camp X . . . . .	25	4894		20	1 : 1,250	11
Camp XI . . . . .	20.5	4936	42		1 : 488	12

TABLE OF THE MORPHOLOGICAL ELEMENTS.

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1906
						September
Camp XII . . . . .	14.5	4981	45		1:322	13
Camp XIII . . . . .	13.5	5018	37		1:365	14
Camp XIV . . . . .	14	5170	152		1:92	15
Threshold . . . . .	11	5273	103		1:107	16
Camp XV, Lake Lighten . .	6.5	5095		178	1:37	16
Camp XVI . . . . .	9	5096				20
S. shore, Lake Lighten . . .	7	5095				21
E. shore, Lake Lighten . . .	23	5095				21
Camp XVII . . . . .	3.7	5100				21
Threshold . . . . .	12	5301	201		1:60	22
Camp XVIII . . . . .	1.7	5168		133	1:13	22
Camp XIX, Yeshil-kol . . .	10	4946		222	1:45	23
Camp XX . . . . .	14.1	4945				24
Camp XXI . . . . .	2.6	4955	10		1:260	25
Camp XXII . . . . .	16.2	5040	85		1:191	26
Threshold . . . . .	10.5	5080	40		1:262	27
Camp XXIII . . . . .	4.7	5078		2	1:2350	27
Camp XXIV . . . . .	7.8	5077				28
Camp XXV . . . . .	15.2	5078				29
Threshold . . . . .	14.8	5239	161		1:92	30
Camp XXVI . . . . .	1.4	5141		98	1:14	30
						October
Camp XXVII . . . . .	9.5	5081		60	1:158	1
Camp XXVIII . . . . .	16.7	5137	56		1:298	2
Camp XXIX . . . . .	15.8	5091		46	1:343	3
Camp XXX . . . . .	13.7	5024		67	1:204	4
Camp XXXI . . . . .	14.3	4939		85	1:168	5
Camp XXXII . . . . .	14.6	4877		62	1:235	6
Camp XXXIII . . . . .	12.3	4923	46		1:267	7
Camp XXXIV . . . . .	15.5	4996	73		1:212	8
Camp XXXV . . . . .	10.5	5033	37		1:284	10
Threshold . . . . .	6	5253	220		1:27	11
Camp XXXVI . . . . .	11.3	4978		275	1:41	11
Camp XXXVII . . . . .	8.7	5129	151		1:58	12
Pass . . . . .	7.1	5306	177		1:40	13
Camp XXXVIII . . . . .	4.3	5207		99	1:43	13
Camp XXXIX . . . . .	12.3	5100		107	1:115	14
Camp XL . . . . .	10.5	5000		100	1:105	15
Camp XLI . . . . .	8	5061	61		1:131	16
Camp XLII . . . . .	14.3	5247		186	1:77	17
Pass . . . . .	5	5357	110		1:46	18
Camp XLIII . . . . .	4.3	5292		65	1:66	18
Camp XLIV . . . . .	7	5346	54		1:130	19
Pass . . . . .	4	5611	265		1:15	20
Camp XLV . . . . .	6.2	5386		225	1:28	20
Pass . . . . .	4.7	5491	105		1:45	21
Camp XLVI . . . . .	2.5	5390		101	1:25	21
Pass . . . . .	5.5	5501	111		1:50	22
Camp XLVII . . . . .	5.6	5223		278	1:20	22
Camp XLVIII . . . . .	5.9	5153		70	1:84	24



Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1906
						October
Camp XLIX . . . . .	19.8	5205	52		1:381	28
Camp L . . . . .	11.2	5125		80	1:140	29
Camp LI . . . . .	7.1	5040		85	1:84	30
						November
Camp LII. . . . .	18.5	5019		21	1:881	3
Camp LIII . . . . .	13	5046	27		1:482	4
Camp LIV . . . . .	12.7	5158	112		1:113	5
Camp LV . . . . .	10.3	5011		147	1:70	6
Camp LVI . . . . .	11.3	5016	5		1:2260	7
Pass . . . . .	8.5	5161	145		1:59	8
Camp LVII . . . . .	4.5	4994		167	1:27	8
Camp LVIII. . . . .	16.6	4889		105	1:158	9
Camp LIX, Lungnak . . . . .	14.5	4992	103		1:141	10
Camp LX, Gomo . . . . .	16.3	4843		149	1:109	12
Camp LXI . . . . .	14	4950	107		1:131	14
Camp LXII . . . . .	10.3	5038	88		1:117	15
Camp LXIII. . . . .	13	5211	173		1:75	16
Chakchoni-la . . . . .	7.2	5433	222		1:32	17
Camp LXIV . . . . .	5	5042		391	1:13	17
Camp LXV . . . . .	10.3	4914		128	1:80	19
Camp LXVI, Ngemba-tokchen . . . . .	17.8	4928	14		1:1.271	20
Camp LXVII, Chupka-karmo-lungpa . . . . .	9.2	5167	259		1:38	21
Camp LXVIII, Kebe-chungu . . . . .	9.6	5003		164	1:58	22
Pass . . . . .	3.2	5103	100		1:32	23
Camp LXIX . . . . .	9	4999		104	1:86	23
Camp LXX . . . . .	11.8	4904		95	1:124	24
Camp LXXI, Rinek-chutsan . . . . .	12.3	4706		198	1:62	25
Camp LXXII . . . . .	4.8	4819	113		1:42	26
Pass Yumrang-lopchangs . . . . .	4.3	5032	213		1:20	27
Camp LXXIII . . . . .	9.7	4753		279	1:35	27
Camp LXXIV, Bogar-yung . . . . .	10.3	4643		110	1:94	28
Camp LXXV . . . . .	12.5	4503		140	1:89	29
						December
Camp LXXVI, Chu-minyung . . . . .	11.2	4673	170		1:66	1
Camp LXXVII, Chulu-rang . . . . .	13.3	4891	218		1:61	2
Camp LXXVIII . . . . .	10.5	4784		107	1:98	3
Camp LXXIX . . . . .	14.1	4816	32		1:441	4
Camp LXXX, Shurang . . . . .	12.2	4760		46	1:218	5
Camp LXXXI . . . . .	12.5	4788	28		1:446	7
Camp LXXXII, Pati-bo . . . . .	8.1	4707		81	1:100	8
Camp LXXXIII . . . . .	7.5	4652		55	1:136	9
Camp LXXXIV . . . . .	9	4696	44		1:205	10
Camp LXXXV . . . . .	10	4664		32	1:313	11
Camp LXXXVI, Nasa . . . . .	10.5	4770	106		1:99	12
Pass Gyanyak-la . . . . .	4.2	5161	391		1:10.7	13
Camp LXXXVII, Lar . . . . .	2.8	4875		276	1:10.1	13
Camp LXXXVIII, Rara . . . . .	7.5	5169	294		1:25.5	15
Pass Pike-la . . . . .	0.6	5200	31		1:19	16

TABLE OF THE MORPHOLOGICAL ELEMENTS.

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1906/07
						December
Camp LXXXIX, Lung-chung	10.4	4867		333	1:31	16
Camp XC, Neka . . . . .	9.7	4759		108	1:90	17
Camp XCI, Kunglung . . . .	11.2	4793	34		1:329	20
Pass Sarya-la . . . . .	5.8	4865	72		1:81	21
Camp XCII, Nadsum . . . .	3.9	4805		60	1:65	21
Camp XCIII, Sunju . . . .	9.4	4871	66		1:142	22
Camp XCIV, Tomo-chapko .	10	4932	61		1:164	23
Pass Lamlung-la . . . . .	14.5	5179	247		1:59	24
Camp XCV, Kachen . . . .	4.1	4828		351	1:11.7	24
Camp XCVI, Laen . . . . .	11	4824		4	1:2750	26
Camp XCVII . . . . .	4.5	4770		54	1:83	27
Camp XCVIII, N. shore	7.8	4699				29
Camp XCIX, S. shore . .	14.3	4702		71	1:110	30
Camp C, N. W. shore . .	12.5	4694				31
						January 1907
Camp CI, S. shore . . . .	11.7	4694				1
Camp CII, S. W. shore . .	11	4694				2
Camp CIII . . . . .	18	4699				3
Camp CIV, Panglung . . .	6.5	4694				4
Camp CV, N. E. shore . .	9.8	4700				5
Camp CVI, S. E. shore . .	14	4695				6
Camp CVII . . . . .	13.7	4767				7
Camp CVIII, S. E. shore .	20.5	4699				17
Camp CIX . . . . .	6	5189	495		1:12.1	18
Pass Chapkar-la . . . . .	1	5326	137		1:7.3	19
Camp CX, Lamblung . . . .	9.8	4895		431	1:22.7	19
Pass Pongchen-la . . . . .	5	5371	476		1:10.5	22
Camp CXI . . . . .	6.7	5055		316	1:21.2	22
Camp CXII, Kapchor . . . .	12.6	4959		96	1:131	23
Camp CXIII, Kayi-pangbuk .	17	4930		29	1:580	24
Camp CXIV, Nadsum . . . .	12.2	4986	56		1:218	25
Camp CXV . . . . .	15.8	5134	148		1:106.7	26
Camp CXVI . . . . .	14	5344	210		1:66.6	27
Pass Sela-la . . . . .	16	5506	162		1:99	28
Camp CXVII . . . . .	2.9	5225		281	1:10.3	28
Camp CXVIII, Selin-do . .	15.8	4832		393	1:40.2	29
Pass Shib-la . . . . .	20	5349	517		1:38.7	30
Camp CXIX, Tagar-ogma . .	3.8	4998		351	1:10.8	30
						February
Pass Chesang-la . . . . .	10.6	5474	476		1:22.3	1
Camp CXX, Tak-rerar . . . .	10.1	4635		839	1:12	1
River Bup-chu . . . . .	6	4467		168	1:35.7	2
Camp CXXI, Tamring . . . .	7.7	4619	152		1:50.7	2
Pass Dangbā-la . . . . .	11.4	5250	631		1:18	3
Camp CXXII, Ngartang . . .	13	4909		341	1:38	3
Pass Ta-la . . . . .	10	5436	527		1:18.9	4
Camp CXXIII, Hor . . . . .	11.8	4523		913	1:12.9	4
Camp CXXIV, Shepa-kava . .	7.2	4344		179	1:40.2	5
Pass La-rok . . . . .	7	4440	96		1:73	6

TABLE OF THE MORPHOLOGICAL ELEMENTS.

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1907
Camp CXXV, Ye . . . . .	8.6	3988		452	1:19	February 6
Camp CXXVI, Rungma . . .	10.7	3950		38	1:281	7
						April
Camp CXXXVI, Tangna . . .		4038				
Camp CXXXVII, Lingo . . .	14.9	4070	32		1:466	7
Camp CXXXVIII, Tong . . .	14.3	4167	97		1:147	8
Camp CXXXIX, Ge . . . . .	9	4204	37		1:243	10
Camp CXL, Sirchung . . . .	16	4177		27	1:593	11
Camp CXLI, Kating . . . . .	12.6	4229	52		1:242	12
Camp CXLII, Linga . . . . .	16	4302	73		1:219	13
Camp CXLIII, Langmar . . .	9.6	4403	103		1:93	17
Camp CXLIV, Govo . . . . .	12	4524	121		1:99	18
Camp CXLV, Chomo-sumdo	19.2	4795	271		1:71	20
Pass Chang-la-Pod-la . . . .	9.2	5572	777		1:11.8	21
Camp CXLVI, Cha-oktsang . .	6	5233		339	1:17.7	21
Camp CXLVII, Kyang-dam . .	14.7	5050		183	1:80	22
Pass Chumar-la . . . . .	18	5108	58		1:310	24
Camp CXLVIII, Bumnak . . .	6.6	4945		163	1:40	24
Pass Ting-la . . . . .	1.8	5105	160		1:11.2	25
Camp CXLIX, Kokbo . . . . .	10	5110	5		1:2000	25
Pass Tarbung-la . . . . .	4.5	5267	157		1:28.7	26
Camp CL, Targo-tsangpo . . .	16.2	4708		559	1:29	26
Camp CLI, Tsangdam . . . . .	12.3	4758	50		1:246	30
						May
Camp CLII, Parva . . . . .	18.6	4753		5	1:3720	1
Camp CLIII, Kyangdam . . . .	12.4	4739		14	1:886	2
Pass Dunka-la . . . . .	4.7	5030	291		1:16	4
Camp CLIV, Sabuk . . . . .	14	4947		83	1:171	4
Pass Bang-la . . . . .	3.7	5237	290		1:12.7	5
Camp CLV, Angjum . . . . .	7.2	5186		51	1:141	5
Pass Angden-la . . . . .	6.4	5643	457		1:14	6
Camp CLVI, Kyam . . . . .	12.6	4954		689	1:18.3	6
Camp CLVII, Amchok-tso . . .	17.2	4870		84	1:205	7
Camp CLVIII, Serme-lartsa . .	9	5310	440		1:20.4	10
Pass Sao-lungring . . . . .	5.3	5387	77		1:68.9	11
Pass . . . . .	9	5384				11
Camp CLIX, Tsarok . . . . .	3.2	4861		523	1:6.1	11
Camp CLX, Yo'on . . . . .	17.8	4919	58		1:307	12
Camp CLXI, Raga-tasam . . . .	12.7	4948	29		1:438	13
Camp CLXII, Chosang-jung . . .	16	5006	58		1:276	21
Pass Ravak-la . . . . .	6.6	5227	221		1:30	22
Camp CLXIII, Kichung- sumna . . . . .	1.1	5198		29	1:34	22
Pass Kichung-la . . . . .	3.4	5504	306		1:11	23
Pass . . . . .	3	5480				23
Pass Kanglung-la . . . . .	1	5528				23
Camp CLXIV, Lungle . . . . .	3	5251		277	1:10.8	23
Camp CLXV, Pang-satak . . . .	14.5	4916		335	1:43.3	24
Camp CLXVI, Basang . . . . .	7	4796		120	1:58	25
Pass Gyabuk-la . . . . .	8.9	4823	27		1:329	27

TABLE OF THE MORPHOLOGICAL ELEMENTS.

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1907
						May
Camp CLXVII, Kyärkyä . . .	6.8	4575		248	1:27.4	27
Camp CLXVIII, Tsangpo . .	10.8	4524		51		28
Camp CLXIX, Takbur . . .	13.1	4532	8		1:1638	30
						June
Pass Takbur-la. . . . .	7	5066	534		1:13	1
Camp CLXX, Saka-dsong . .	14.8	4616		450	1:33	1
Camp CLXXI, Targyaling- gompa . . . . .	15.7	4574		42	1:37.4	7
Camp CLXXII, Pasa-guk . .	8.7	4586	12		1:725	8
Camp CLXXIII, Churu . .	15.6	4628	42		1:371	10
Camp CLXXIV, Rok-shung .	10.8	4609		19	1:568	11
Camp CLXXV, Nyuku . . .	15.1	4600		9	1:1677	12
Camp CLXXVI, Kyum-ngoya .	15.2	4670	70		1:217	14
Camp CLXXVII, Konak . .	10.3	4729	59		1:175	15
Pass Kilung-la . . . . .	14.6	5318	589		1:25	16
Pass Särchung-la . . . . .	7	5188	459		1:15	17
Camp CLXXVIII, Dambok- rong . . . . .	12.5	4657		531	1:23.5	17
Camp CLXXIX, Tradum . .	12.1	4591		66	1:183	18
Camp CLXXX, Likse-gompa .	10.6	4565		26	1:408	20
Camp CLXXXI . . . . .	33.8	4595	30		1:1127	21
Pass Kore-la . . . . .	3.3	4637	42		1:78.6	22
Camp CLXXXII, Nama-shu From water-parting . . .	14.1	3806		831	1:17	22
to Camp CLXXXIII, Kung- muge . . . . .	6.2	4603		58	1:107	23
Camp CLXXXIV, Bando . .	24.8	4594		9	1:2755	24
Camp CLXXXV, Chikum . .	10.2	4796	202		1:50.5	25
Pass Tagu-la . . . . .	1.6	5026	230		1:7	26
Camp CLXXXVI, Tambap . .	9.5	4785		241	1:39	26
Camp CLXXXVII, Nagor . .	17.3	4608		177	1:98	27
Camp CLXXXVIII, Brahma- putra . . . . .	12	4583		25	1:480	28
Camp CLXXXIX, Dongbo . .	5	4598	15			29
Camp CXC, Tuksum . . . .	22.7	4596	13		1:1746	30
						July
Camp CXCI . . . . .	9.6	4608	12		1:800	2
Camp CXCI, Yuri . . . . .	15.7	4615	7		1:2243	3
Camp CXCII, Nangi . . . .	32.3	4627	12		1:2692	4
Camp CXCIV, Gyang-chu- kamar . . . . .	13.3	4661	34		1:391	5
Camp CXCV, Chärok . . . .	19.3	4657		4	1:4825	6
Camp CXCVI, Shamsang . .	8.8	4697	40		1:220	7
Camp CXCVII, Umboo . . .	6.7	4702	5		1:1340	8
Camp CXCVIII, Tok-jonsung	14.8	4732	30		1:493	9
Camp CXCI, Shäryak . . .	12.5	4874	142		1:88	10
Pass Tso-niti-kargang . . .	6.5	5138	264		1:24.7	11
Camp CC, Hlayak . . . . .	5.5	4861		277	1:20	11
Camp CCI, Shapka . . . . .	17.6	4841		20	1:880	12
Langta-chen Glacier . . . .	8.8	5015	174		1:46	13

TABLE OF THE MORPHOLOGICAL ELEMENTS.

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1907
						July
Moraine . . . . .	3.7	5310	469		1: 7.9	14
Camp CCII, Dongdong . .	10.2	4844		466	1: 22	14
Pass Kargang-la . . . . .	9.6	5182	338		1: 28	15
Camp CCIII, Dara-sumkor .	4.8	4931		251	1: 19	15
Pass Tugri-la . . . . .	5.5	5270	339		1: 16.2	16
Camp CCIV, Bukgyayarap .	10.8	4870		400	1: 27	16
Camp CCV, Tunchung . . .	8.5	4987	117		1: 73	17
Pass Maranyak-la . . . .	12.7	5302	315		1: 40.3	18
Camp CCVI, Loang-goa . .	7	5036		266	1: 26	18
Pass Tamlung-la . . . . .	17.6	5279	243		1: 72.4	19
Camp CCVII, Chian-karpo .	5.2	5133		146	1: 36	19
Camp CCVIII, Tag-ramoche	15.5	4948		185	1: 84	20
Camp CCIX, Tso-nyak . . .	16	4840		108	1: 148	21
Camp CCX, Namarden . . .	9.3	4720		120	1: 77	22
Pass Karpo-la . . . . .	9.8	4888	168		1: 58	23
Camp CCXI, Tokchen . . . .	7.5	4635		253	1: 29	23
Camp CCXII, Manasarovar .	9.2	4602		33	1: 279	26
Camp CCXXX, Khaleb . . . .		4629				
Camp CCXXXI, Diri-pu- gompa . . . . .	20.1	5091	462		1: 43.5	3
Pass Dolma-la . . . . .	1.3	5669	578		1: 2.25	4
Camp CCXXXII, Tsumtul-pu- gompa . . . . .	16.2	4863		806	1: 20.1	4
Camp CCXXX, Khaleb . . . .	17.6	4629		234	1: 75	5
Camp CCXXXIII, Diri-pu- gompa . . . . .		5092				
Pass Tseti-la . . . . .	12.3	5628	536		1: 23	7
Pass Tseti-lachen-la, (Near Camp CCXXXIV) . . . . .	4.7	5466		162	1: 29	7
Camp CCXXXV, Singe-buk . .	23	5079		387	1: 59	9
Camp CCXXXVI, Singi-kabab	11	5165	86		1: 128	10
Pass Lamo-latse-la . . . .	16.5	5426	261		1: 63	11
Camp CCXXXVII . . . . .	3.7	5176		250	1: 15	11
Camp CCXXXVIII, Dam- tärngo . . . . .	19.5	4991		185	1: 105	12
Pass Dam-Kärchen-la . . .	8.3	5099	108		1: 77	13
Camp CCXXXIX, Gyamboche	13	4804		295	1: 44	13
Camp CCXL . . . . .	20.1	4624		180	1: 112	14
Camp CCXLI, Gyakung . . .	10.5	4802	178		1: 59	15
Camp CCXLII, Govu . . . .	17.7	4660		142	1: 124	17
Camp CCXLIII, Luma-rigmo	23	4614		46	1: 500	18
Camp CCXLIV, Sariyol . . .	28.2	5021	407		1: 69	19
Pass Bokar-la . . . . .	6	5178	157		1: 38	20
Indus . . . . .	14.8	4782		396	1: 37	20
Camp CCXLV, Sambuk- sumdo . . . . .	11.3	4698		84	1: 134	20
Camp CCXLVI, Hlagar . . .	10.1	4672		26	1: 388	21
Camp CCXLVII, Dotsa . . .	21.2	4885	213		1: 100	22
Camp CCXLVIII, Nyanda- nakbo . . . . .	31.3	4855		30	1: 1043	23

TABLE OF THE MORPHOLOGICAL ELEMENTS.

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1907/08
Camp CCXLIX, Takto-serpo	14.5	5166	311		1:46.6	September 24
Pass Jukti-hloma-la . . . .	13	5825	659		1:19.7	25
Camp CCL, Dung-lung-sumdo	9.4	5171		654	1:14.4	25
Camp CCLI, Gartok . . . .	19.4	4469		702	1:27.6	26
Camp CCLI, Gartok . . . .		4469				October
Camp CCLII, Nima-lung . .	15.7	4422		47	1:33.4	20
Camp CCLIII, Luma-ngoma	18.3	4372		50	1:33.6	21
Camp CCLIV, Gar-gunsa . .	26	4287		85	1:30.6	22
						November
Camp CCLV, Chiu . . . .	13.7	4266		21	1:65.2	9
Camp CCLVI, Langmar . . .	24	4258		8	1:30.00	10
Camp CCLVII, Singi-kamba	9.5	4254		4	1:23.5	11
Camp CCLVIII, Tashi-gang	12.6	4248		6	1:21.00	13
Camp CCLIX, Tarae-kongma	12.3	4244		4	1:30.75	15
Camp CCLX, Demchok . .	11.5	4274				16
Camp CCLXI, Nagangkal . .	28	4229				17
Camp CCLXII, Puktse . . .	12.9	4190		39	1:33.1	18
Camp CCLXIII, Dungkang	16	4186		4	1:40.00	19
Camp CCLXIV, Lung-kung .	17.3	4179		7	1:24.71	20
Camp CCLXV, Dung-lung .	24	4449	270		1:8.9	21
Pass Tsake-la . . . . .	4.2	4653	204		1:20.6	22
Camp CCLXVI, Chushul . .	29.3	4359		294	1:10.0	22
Pass Kongta-la . . . . .	11.2	5061	702		1:16	24
Camp CCLXVII, Kongma-lung-kongma . . . . .	12.1	4777	284		1:43	24
Camp CCLXVIII, Sara . . .	30	4411		366	1:8.2	25
Camp CCLXIX, Tankse . .	22	3990		421	1:5.2	26
Camp CCLXXXI, Long . . .		4663				December
Camp CCLXXXII, Bulak . .	11.3	4544				18
Camp CCLXXXIII, Burtse . .	19.5	4808	264		1:7.4	19
Highest point in valley . .	16.6	5040	232		1:7.1	20
Camp CCLXXXIV . . . . .		4995				20
Camp CCLXXXV . . . . .		4880				21
Camp CCLXXXVI, Kasil-unkur . . . . .	from Burtse 14.4	5128	320		1:4.5	23
Pass Dapsang . . . . .	4	5428	300		1:13.3	24
Camp CCLXXXVII . . . . .	11.4	5227		201	1:54.7	24
Camp CCLXXXVIII . . . .	12	5208		19	1:63.2	25
Camp CCLXXXIX . . . . .	18.6	5383	175		1:10.6	26
Camp CCXC . . . . .	4.8	5379		4	1:12.00	27
Camp CCXCI . . . . .	13.4	5299		80	1:16.8	28
Camp CCXCII . . . . .	12.8	5246		53	1:24.1	29
Camp CCXCIII . . . . .	8.8	5140		106	1:8.3	30
						January 1908
Camp CCXCIV . . . . .	10	5300	160		1:6.3	1
Camp CCXCV . . . . .	13.5	5088		212	1:6.4	2
Camp CCXCVI . . . . .	16.3	5201	113		1:14.4	3
Pass . . . . .	10.2	5485	284		1:3.6	5
Camp CCXCVII . . . . .	2.4	5260		225	1:10.7	5
Pass . . . . .	8.8	5488	228		1:3.9	6

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1908
						January
Camp CCXC VIII . . . . .	7.6	5148		340	1:22.4	6
Threshold . . . . .	7.9	5355	207		1:38	8
Camp CCXC IX . . . . .	7.9	5165		190	1:42	8
Camp CCC . . . . .	5.6	4977		188	1:30	9
Camp CCC I . . . . .	24.8	4916		61	1:407	10
Camp CCC II, Lake Aksai-chin	17.5	4914		2		11
Camp CCC III . . . . .	22.3	4955	21		1:1062	13
Camp CCC IV . . . . .	17.7	4945	10		1:1770	14
Camp CCC V . . . . .	11	5058	113		1:98	15
Pass . . . . .	4.2	5161	103		1:41	16
Camp CCC VI . . . . .	6	5095		66	1:91	16
Camp CCC VII . . . . .	12	5110	15		1:800	18
Camp CCC VIII . . . . .	12.5	5305	195		1:64	19
Camp CCC IX . . . . .	12.3	5242		63	1:195	20
Camp CCC X . . . . .	12	5244	2			22
Pass . . . . .	4.6	5291	47		1:98	24
Camp CCC XI . . . . .	10.8	5296	5		1:2160	24
Camp CCC XII . . . . .	13.1	5337	41		1:320	25
Camp CCC XIII, Airport-tso .	14.6	5298		39	1:374	26
Camp CCC XIV, Airport-tso .	2	5298				27
Pass . . . . .	11.4	5572	274		1:42	28
Camp CCC XV . . . . .	6	5374		198	1:31	28
Camp CCC XVI . . . . .	13.4	5480	106		1:126	29
Threshold . . . . .	8.2	5568	88		1:93	30
Camp CCC XVII . . . . .	9	5325		243	1:37	30
Camp CCC XVIII . . . . .	4.7	5249		76	1:62	31
						February
Camp CCC XIX, Shemen-tso	16.7	5002		247	1:68	1
Camp CCC XX, Shemen-tso	15.6					4
Camp CCC XXI, Shemen-tso	8.6					5
Camp CCC XXII, Shemen-tso	12.3					6
Camp CCC XXIII . . . . .	8.3	4960				7
Camp CCC XXIV . . . . .	8.1	4874		86	1:94	8
Camp CCC XXV . . . . .	11.3	4901	27		1:418	9
Camp CCC XXVI . . . . .	7.9	4941	40		1:198	10
Camp CCC XXVII . . . . .	12.7	5055	114		1:111	11
Camp CCC XXVIII . . . . .	10	5317	262		1:38	12
Camp CCC XXIX . . . . .	11	5345	28		1:393	14
Pass . . . . .	8.4	5655	310		1:27	15
Camp CCC XXX . . . . .	9.4	5556		99	1:95	15
Camp CCC XXXI . . . . .	7.4	5422		134	1:55	16
Camp CCC XXXII . . . . .	15.9	5275		147	1:108	17
Camp CCC XXXIII . . . . .	10.1	5181		94	1:107	18
Camp CCC XXXIV . . . . .	18	4933		248	1:73	19
Camp CCC XXXV, Lemchung-tso . . . . .	11.3	4820		113	1:100	20
Camp CCC XXXVI . . . . .	9.3	4878	58		1:160	22
Camp CCC XXXVII . . . . .	14.3	4992	114		1:125	23
Camp CCC XXXVIII . . . . .	11.8	5118	126		1:94	24
Camp CCC XXXIX . . . . .	10	5108		10	1:1000	25

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1908
						February
Camp CCCXL, Takmar . . .	11.4	4876		232	1:49	26
Camp CCCXLI, Senes-yung- ringmo . . . . .	12.7	4669		207	1:61	27
Camp CCCXLII . . . . .	17.7	4759	90		1:197	28
Camp CCCXLIII, Lumbur- ringmo . . . . .	11.7	4633		126	1:93	29
						March
Camp CCCXLIV . . . . .	10.7	4760	127		1:84	3
Threshold . . . . .	7.6	4886	126		1:60	4
Camp CCCXLV, Pankur . . .	3.4	4748		138	1:24	4
Depression . . . . .	5.4	4649			1:55	5
Camp CCCXLVI . . . . .	7.4	4704	55		1:135	5
Camp CCCXLVII . . . . .	10	4663		41	1:244	6
Camp CCCXLVIII . . . . .	13	4740	77		1:169	7
Camp CCCXLIX, Nagrong . .	12.7	4644		96	1:132	8
Camp CCCL . . . . .	14.7	4628		16	1:919	10
Camp CCCLI . . . . .	8.6	4531		97	1:88	11
Camp CCCLII . . . . .	10.4	4568	37		1:281	12
Camp CCCLIII . . . . .	11.6	4534		34	1:341	14
Camp CCCLIV, Tongka-tso . .	16.3	4511		23	1:709	15
Camp CCCLV, Tongka . . .	7.6	4507		4	1:1900	16
Camp CCCLVI, Ganpo-gatle .	10.4	4505		2		17
Camp CCCLVII . . . . .	7.8	4773	268		1:29	18
Pass . . . . .	2.2	4918	145		1:15	19
Camp CCCLVIII . . . . .	6	4890		28	1:214	19
Pass Yum-tso-la . . . . .	1.2	4955	65		1:18.5	20
Camp CCCLIX, Luma-shar . .	8.4	4768		187	1:44	20
Pass . . . . .	4	4972	204		1:20	21
Camp CCCLX, Kombak . . .	3.4	4882		90	1:38	21
Camp CCCLXI . . . . .	8	5029	147		1:54	22
Pass Chaklam-la . . . . .	3.4	5285	256		1:13.3	23
Camp CCCLXII . . . . .	5.3	4905		380	1:13.9	23
Camp CCCLXIII . . . . .	10.7	5026	121		1:88	24
Pass Sangchen-la . . . . .	5	5356	330		1:15	26
Camp CCCLXIV, Nema-tok . .	3.3	4946		410	1:8	26
Pass Ladung-la . . . . .	3.5	5302	356		1:10	27
Camp CCCLXV, Yanglung . .	3.9	4878		424	1:9	27
Camp CCCLXVI . . . . .	8.2	4741		137	1:60	28
Camp CCCLXVII . . . . .	13	4628		113	1:115	29
Depression . . . . .	8	4580		16	1:167	30
Camp CCCLXVIII, Nila-yung- karpo . . . . .	2.6	4612	32		1:81	30
Camp CCCLXIX . . . . .	10.7	4805	193		1:55	31
						April
Pass Satsot-la . . . . .	2	4856	51		1:39	1
Camp CCCLXX, Chunit-tso . .	7.8	4747		109	1:72	1
Camp CCCLXXI, Sninkuk . .	14.5	4747				2
Camp CCCLXXII, Kemar . . .	11.3	4846	99		1:114	3
Pass Nima-lung-la . . . . .	4	4882	36		1:111	4
Camp CCCLXXIII . . . . .	10.8	4784		98	1:110	4



Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1908
						April
Camp CCCLXXIV . . . . .	16.4	4806	22		1: 745	5
Camp CCCLXXV, Monlam- kongma. . . . .	9.8	4822	16		1: 613	6
Camp CCCLXXVI, Amchung	13.9	4835	13		1: 1069	8
Camp CCCLXXVII . . . . .	9.6	4883	48		1: 200	9
Camp CCCLXXVIII . . . . .	13.7	4905	22		1: 623	10
Camp CCCLXXIX, Bupyung- ring . . . . .	13.8	4911	6		1: 2300	11
Camp CCCLXXX . . . . .	11.5	4968	57		1: 202	13
Camp CCCLXXXI . . . . .	8.2	5370	402		1: 20.4	14
Pass Samye-la . . . . .	8.5	5527	157		1: 54	15
Camp CCCLXXXII . . . . .	3.4	5366		161	1: 21	15
Camp CCCLXXXIII . . . . .	13.3	4945		421	1: 31.5	16
Camp CCCLXXXIV . . . . .	14	4832		113	1: 124	17
Camp CCCLXXXV . . . . .	15.3	4696		136	1: 112.5	18
Camp CCCLXXXVI, Charte	11.8	4634		62	1: 190	19
Camp CCCLXXXVII, Kan- chung-chu. . . . .	13.8	4702	68		1: 203	20
Camp CCCLXXXVIII . . . . .	13.7	4865	163		1: 84	21
Camp CCCLXXXIX . . . . .	12	5001	136		1: 88	22
Pass Gyabuk-la . . . . .	6	5175	174		1: 34	23
Camp CCCXC. . . . .	6.3	5079		96	1: 66	23
Pass Kinchen-la . . . . .	10.6	5441	362		1: 29	24
Camp CCCXCI . . . . .	3.6	5209		232	1: 15.5	24
Camp CCCXCII, Rapak-do . . . . .	9.6	5103		106	1: 91	25
Camp CCCXCIII. . . . .	17.7	4656		447	1: 40	26
Camp CCCXCIV, Semo-ku	3.5	4596		60	1: 58	27
Camp CCCXCV, Ushü . . . . .	12	4563		33	1: 364	29
Pass Gyä-la . . . . .	9.5	4918	355		1: 26.8	30
Camp CCCXCVI, Lumbo- taksen . . . . .	7.4	4780		138	1: 54	30
						May
Pass Lamlung-la . . . . .	4.4	5118	338		1: 13	1
Camp CCCXCVII, Namchen	3.3	4982	136		1: 24	1
Pass Gara-la. . . . .	6.3	5033	51		1: 123	4
Camp CCCXCVIII, Tangma-ni	2.3	4922		111	1: 21	4
Pass Shalung-la . . . . .	10	5320	398		1: 25	6
Camp CCCXCIX, Gyagong . . . . .	1.6	5114		206	1: 8	6
Pass Gyagong-la . . . . .	6	5490	376		1: 16	7
Camp CCCC . . . . .	8.4	5333		157	1: 53.5	7
Pass Damche-la . . . . .	4.4	5418	85		1: 52	8
Camp CCCCII, Lapchung . . . . .	10.7	5193		225	1: 47.5	8
Camp CCCCIII, Sang-bertik . . . . .	15.2	5245	52		1: 292	9
Camp CCCCIII, Sangmo- bertik . . . . .	12.2	5586	341		1: 35.8	11
Pass Sangmo-bertik-la . . . . .	4.8	5820	234		1: 20.5	12
Camp CCCCIV . . . . .	9.1	5435	385		1: 23.6	12
Camp CCCCIV . . . . .	15.8	5121		314	1: 50.3	13
Camp CCCCVI . . . . .	13.8	4964		157	1: 88	14
Camp CCCCVII, Kangmar . . . . .	19.7	4783		181	1: 109	15

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1908
						May
Camp CCCCVIII, Daksha- lungpa . . . . .	18.6	5150	367		1:51	17
Camp CCCCIX . . . . .	14	4714		436	1:32	18
Pass Teta-la . . . . .	7.4	4958	244		1:30.3	19
Camp CCCCX, Hlakelung . . . . .	5	4769		189	1:26.5	19
Pass Lamlung-la . . . . .	6.5	5145	376		1:17.5	24
Camp CCCCXI, Kibuk-hle . . . . .	8.8	4689		456	1:19.5	24
Camp CCCCXII, Tertsu . . . . .	12.1	4679				25
Camp CCCCXIII, Mendong- gumpa . . . . .	22	4693	14		1:157.1	26
Camp CCCCXIV, Sok-yung . . . . .	12.7	4714	21		1:60.5	28
Camp CCCCXV, Goa-lung . . . . .	17	5022	308		1:55	29
Pass Goa-la . . . . .	6.2	5298	276		1:22.4	30
Camp CCCCXVI, Changsa- lungpa . . . . .	9.4	5035		263	1:36	30
						June
Camp CCCCXVII, Tamo-yak- shung . . . . .	13.7	4725		310	1:44	1
Camp CCCCXVIII, Saglam- lungpa . . . . .	20.6	4786	61		1:338	2
Camp CCCCXIX, Gole-tata . . . . .	11.7	4788	2			3
Camp CCCCXX, Kebyang . . . . .	16.4	4776		12	1:1367	4
Camp CCCCXXI, Mabye- tangsang-angmo . . . . .	15.5	4704		72	1:215	5
Camp CCCCXXII, Tuta . . . . .	11.3	4664		40	1:282	6
Camp CCCCXXIII, Tarok- shung . . . . .	16	4632		32	1:500	7
Camp CCCCXXIV, Lungkar- gumpa . . . . .	12	4787	155		1:77	9
Pass Lungkar-la . . . . .	9.7	5570	783		1:12.4	10
Camp CCCCXXV, Goang- shung . . . . .	3.4	5349		221	1:15.4	10
Camp CCCCXXVI, Gyānor- tsangpo . . . . .	14.5	5187		162	1:89	11
Pass Chuka-la . . . . .	10	5320	133		1:75	12
Camp CCCCXXVII, Tokya . . . . .	2.7	5307		13	1:208	12
Camp CCCCXXVIII, Shaktik . . . . .	10.1	5202		105	1:96	13
Camp CCCCXXIX, Surla . . . . .	8.9	5215	13		1:68.5	14
Camp CCCCXXX, Surle-pu . . . . .	14.6	5525	310		1:47	16
Pass Surla-kemi-la . . . . .	3.7	5832	307		1:12	17
Camp CCCCXXXI, Dung- lung . . . . .	9.4	5443		389	1:24	17
Camp CCCCXXXII, Pedang- chu . . . . .	14.6	5069		374	1:39	18
Camp CCCCXXXIII, Tsole- shung . . . . .	22.1	4889		180	1:125	19
Pass Abuk-la . . . . .	14.4	5084	195		1:74	21
Camp CCCCXXXIV, Shovo- tso . . . . .	6.6	4784		300	1:22	21
Pass Tela-mata-la . . . . .	12	5160	376		1:32	22

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1908
						June
Camp CCCCXXXV, Sermokunglung . . . . .	4.1	5041		119	1:34	22
Pass Tayep-parva-la . . . . .	3.1	5452	411		1:8.3	23
Camp CCCCXXXVI, Tayep-parva . . . . .	3	5119		333	1:9	23
Lake Nganglaring-tso . . . . .	3	4746		373	1:8	24
Camp CCCCXXXVII, Kungma-dumly . . . . .	10	4748	2			24
Pass Pu-karu-la . . . . .	7.1	5278	530		1:13	25
Camp CCCCXXXVIII, Pebuk	2.8	4984		294	1:9.5	25
Camp CCCCXXXIX, Sumdang-tsangpo . . . . .	11.9	4758		226	1:53	26
Camp CCCCXL, Selipuk-gompa . . . . .	15	4776	18		1:833	27
Camp CCCCXLI, Rartse . . . . .	8.1	4785	9		1:900	30
						July
Camp CCCCXLII, Kyangyang	22.8	4977	192		1:119	1
Pass Kyangyang-la . . . . .	5.7	5157	180		1:31.7	5
Camp CCCCXLIII, Lavar-demar . . . . .	3.8	5048		109	1:35	5
Camp CCCCXLIV, Kelle . . . . .	13.6	4949		99	1:137	6
Camp CCCCXLV . . . . .	13	5196	247		1:53	7
Pass Ding-la . . . . .	6.6	5885	689		1:9.6	8
Camp CCCCXLVI, Lumanakpo . . . . .	9.8	5138		747	1:13	8
Pass . . . . .	12.7	5233	95		1:134	9
Camp CCCCXLVII, Surngechu . . . . .	4.6	5155		78	1:59	9
Camp CCCCXLVIII, Takche	22.2	5281	126		1:176	10
Surnge-la . . . . .	5.3	5276		5	1:1060	12
Camp CCCCXLIX, Surngelungpa . . . . .	11.3	4917		359	1:31	12
Pass Yübo-la . . . . .	5.6	5242	325		1:17	13
Camp CCCCL . . . . .	5	5027		215	1:23	13
Camp CCCCLI, Upper Tokchen	13.1	4654		373	1:35	14
Camp CCCCLII, Lower Tokchen . . . . .	9.5	4611		43	1:221	24
Camp CCCCLIII, Langbonan-gompa . . . . .	19.3	4602		9	1:2144	25
Camp CCCCLIV, Chiu-gompa	13.5	4602				26
Camp CCCCLV, Rakas-tal . . . . .	15.5	4589		13	1:1193	27
Camp CCCCLVI, Serlep-yung	12.2	4585		4	1:3050	28
Camp CCCCLVII, Chuktalungpa . . . . .	13	4615	30		1:433	29
Camp CCCCLVIII, Dolchugompa . . . . .	10	4517		98	1:102	30
Camp CCCCLIX, Tirthapurishung . . . . .	15.5	4432		85	1:176	31
Camp CCCCLX, Tirthapuri . . . . .	12	4345		87	1:138	August 1

TABLE OF THE MORPHOLOGICAL ELEMENTS.

Camps and Passes	Distance in km.	Altitude in m.	Rise in m.	Fall in m.	Rate	Date 1908
						August
Camp CCCCLXI, Gerik-yung	7.9	4295		50	1:158	2
Camp CCCCLXII . . . . .	9.5	4268		27	1:352	3
Camp CCCCLXIII, Chung- lung-gompa . . . . .	7.5	4259		9	1:833	4
Camp CCCCLXIV, Kande .	21.3	4270	11		1:1936	5
Camp CCCCLXV . . . . .	19.8	4396	126		1:157	6
Camp CCCCLXVI, Dongbo- gompa . . . . .	11.5	4081		315	1:36	7
Top of terrace . . . . .	1.8	4437	356		1:5	8
Camp CCCCLXVII, Yungu- tsangpo . . . . .	6.2	4068				8
Top of terrace . . . . .	3.2	4418	350		1:9	9
Camp CCCCLXVIII, Dava- gompa . . . . .	15.3	4177				9
Camp CCCCLXIX, Mang- lung-karla . . . . .	13	4069		108	1:120	11
Camp CCCCLXX, Mangnang- gompa . . . . .	9	4016		50	1:180	12
Camp CCCCLXXI, Totling .	21	3700		316	1:66	13
Camp CCCCLXXII, Natang .	17	3746	46		1:370	15
Camp CCCCLXXIII . . . .	16	4085	339		1:47	16
Pass . . . . .	1.3	4276	191		1:6.8	17
Camp CCCCLXXIV, Shangse	19	4194		82	1:232	17
Camp CCCCLXXV, Rabgyä- ling-gompa . . . . .	13.5	4166		28	1:482	18
Camp CCCCLXXVI, Karu-sing	13.2	4300	134		1:98	19
Camp CCCCLXXVII, Ldat .	10.8	4478	178		1:61	20
Pass Dato-la . . . . .	2.6	4657	179		1:14.5	21
Ngari-tsangpo . . . . .	3.8	3827		830	1:4.6	21
Camp CCCCLXXVIII, Kol- daktse . . . . .	4.6	4351	524		1:8.8	21
Pass Dambak-la . . . . .	2	4601	250		1:8	22
Saser valley . . . . .	1.6	4322		279	1:5.4	22
Pass Pooche-la . . . . .	6.2	4927	605		1:10.2	22
Camp CCCCLXXIX, Bichutse	9.6	4749		178	1:54	22
Camp CCCCLXXX, Lungun	13.2	4753	4		1:3300	23
Pass Dungmar-la . . . . .	7.6	4858	105		1:72	24
Camp CCCCLXXXI, Yer . .	9.6	3778		1080	1:8.9	24
Pass Rongtotke-la . . . .	9.2	4173	395		1:13.7	25
Camp CCCCLXXXII, Lop- chak . . . . .	3.8	2982		1191	1:3.2	25

## CHAPTER XXXVII.

### SOME REMARKS TO THE HEIGHTS AND DISTANCES.

#### A. VOLUME IV.

As an assistance to the readers of this volume and to the students of my maps and of the Meteorological Journal, I think it necessary to direct their attention to a few discrepancies and errors which it has not been possible to avoid in the course of the printing of this work.

On page 4 of the present volume I have given the height of *Tankse* as being 3,991 m., a figure which was calculated from the observations of my previous journey, or in 1901, and which was entered in the Meteorological Journal in my *Scientific Results*, Vol. V, Part I, a, p. 256. On Pl. 1 of my map, the height of the same place is 3,952 m. Taking the average of all my observations at *Tankse*, we get an altitude of 3,985 m., which has been entered on my Pl. 15, and in the Meteor. Journal, p. 8, and which may be regarded as the most correct.

P. 51 the height of *Camp XIX* is given as being 4,955 m. The Met. Journ. has 4,946 m. and regards the camp as situated 1 m. above the surface of the lake, *Yeshil-köl*. In the text I say it is 10 or 15 m. above the surface of the lake. It is impossible to tell which of the two versions is the most likely. At any rate the difference is of no consequence. According to my observations *Yeshil-köl* is at an altitude of 4,945 m.

The height of the little threshold of *September 27th* is 5,095 m. in my text (p. 54) and on the map. In the Met. Journ. it has been changed to 5,080 m. *Camp XXV* is said (p. 56) to be at 6 m. above the surface of *Pool-tso*, though the Met. Journ. says it is only 1 m. above the lake. Both may be correct. The lake itself is at 5,077 m.

The pass near *Camp LXVII* has 5,169 m. By mistake my text attributes this altitude to the camp, which however, has only 5,167 m. The difference is only 2 m.

In the Meteorol. Journal *Camp CCC* has an altitude of 4,983 m. On the map, Pl. 16, it has 4,977 m. The latter figure is the better.

At *Shemen-tso* we find some discrepancies between the heights of my map and those of Professor EKHOLM in the Meteorol. Journal. Thus, on the map, the

lake has a height of 4,968 m., and *Camp CCCXIX* at 1.5 km. from the western shore = 5,002 m. On account of the altitudes I got for the camps situated east of the lake, we thought it necessary to make the altitude of the lake a few meters lower or 4,950 m. a height which, in the Meteorol. Journ., was also attributed to *Camp CCCXIX*. The 4,968 m. of the map is a misprint for 4,958 m. which was rounded to 4,960 m. in my text. In spite of the fact that *Camp CCCXXIII*, on the map, has 4,896 m., and thus becomes lower than the lake, although the ground rises from the lake to this camp, it is questionable whether it would not have been better not to alter the altitude of the lake at all, but to leave the result of the observations alone. The changing atmospheric pressure is the cause of the apparent anomalies which, as a rule, become visible along the lakes and river-courses. On the hypsometrical map which Colonel H. BYSTRÖM is now constructing in 1:200,000, the *Shemen-tso* has 4,960 m., as in the present volume. According to the observations the height of four camps S. E. of *Shemen-tso* are too low, viz. *Camps CCCXXIII*, *CCCXXIV*, *CCCXXV* and *CCCXXVI*. But in relation to one another, their heights may be fairly correct, except *Camp CCCXXIV*. Still, they have been left unchanged in my text and in the Meteorol. Journ. Only at *Camp CCCXXVII*, 5,055 m., we are above the lake, in spite of the anomalies caused by the changes in the atmospheric pressure.

In the Meteorol. Journ., p. 36, *Camp CXXV*, *Ye*, has 3,988 m., and *Camp CXXVI*, *Rungma* 3,950 m. For these two places my map has 3,949 and 3,940 m. The first two are no doubt more correct if compared with the height at the river. On Pl. 8 of the map *Camp CXXXIII* has an altitude of 4,002 m. Perhaps, after all, the figures of the map are the most reliable.

The height at *Langmar*, *Camp CXLIII*, is found to be 4,331 m., as entered on the map and in my text. In the Meteorol. Journal the height of the place has been altered by interpolation to 4,405 m. The first figure, 4,331, may, however, be the correct one.

On the map, Pl. 10, the height of *Camp CLXIX*, *Takbur*, is 4,521 m. which in my text and in the Meteorol. Journ. has been changed into 4,532 m. on account of the fall of the river.

*Diri-pu-gompa* or *Camp CCXXXI* has on the map an altitude of 5,091 m., which has been corrected to 5,081 m. in the Meteorol. Journal.

The altitude 4,979 m. between *Camp CCXLIV* and *Camp CCXLV*, entered both in my text, p. 383, and on the map, Pl. 13, is incorrect. In the Meteorol. Journal, p. 70, the correct figure, or 4,782 m., is to be found.

The altitude of *Jukti-hloma-la* is 5,825 m. both on the map, Pl. 13, and in my text. In the Meteorol. Journal it has been corrected to 5,821 m. The difference of 4 m. is of no consequence, 5,825 m. may be regarded as definite.

On Pl. 21 and in my text *Camp CCCCX*, *Hlakelung*, has an altitude of 4,769 m. In the Meteorol. Journal this altitude has been altered to 4,744 m. So

is also the case with *Camp CCCCXI, Kibuk-hle*, which on the map and in my text has 4,689 m., but in the Journal 4,709 m. I think the heights of the map may be left as they are. Therefore the altitude of the *Lake Teri-nam-tso*, 4,679 m., may also be regarded as approximately correct.

## B. THE MAP IN 1:300,000.

I have also to direct the reader's attention to a series of misprints and mistakes on the map in 1:300,000 which was constructed and drawn by the late Lieutenant C. J. O. KJELLSTROM. As far as the altitudes are concerned they have already been mentioned above. Still I will give a list of all the *errata* and *observanda* that I have found on the map in question.

On Pl. 1 we have to remember that the height of *Tankse* is 3,985 m. (not 3,952). On Pl. 2 *Lake Lighten* has become too long, as will be seen on the map in 1:200,000 by Colonel H. BYSTROM.

Pl. 5: *Camp LXXI* is called *Kinek-chutsan* instead of *Rinek-chutsan*, and the Swedish word *Gips* stands for English *Gypsum*. Between *Camp LXXV* and *LXXVI* two P indicate points from which I have sketched panoramas. The latter, however, are missing in my Atlas of Panoramas, obviously by reason of the impossibility to identify them.

Pl. 6: At *Camp LXXXIX* and *Camp XC* the red P indicating a panorama has been omitted. *Lakor-deya* should be *Lakor-deja*. The mountains N. E. of *Camp XCII* are called *Nadsum-sherke* (not, as north of *Kunglung*, *Nadsum-cherke*). At *Camp XCIII* a red P is missing. *Camp XCIV* is called *Tomo-shapko* (not *Tomo-chapko*). The mount at *Camp XCV* is *Tso-ri* (not *Tso-si*), and a mountain to the S. W. is *Logung* (not *Logun*). The name *Targut* west of *Ngangtse-tso* is doubtful, and *Tagerak* should be improved into *Tagrak*. The greatest depth of the lake is 10,03 m. (not 10,3 m.).

Pl. 7: the altitude of *Camp CXIII* is 4,930 m. (not 4,910 m.).

Pl. 8: the tributary entering the *Müchu* River at *Camp CXLII* is called *Bup* rather than *Bu*. At *Camp CXLVI* a red P is missing. *Targo* is better than *Targu*. The name *Sha-la* S. W. of *Camp CXLIX* is doubtful.

Pl. 9: Mount *Do-tsängkang* must be moved farther east, as shown on Colonel Byström's map. The altitude of *Camp CLV* is 5,186 m. (not 5,180 m.).

Pl. 10: The altitude of *Camp CLXIX, Takbur*, is 4,532 m. (not 4,521 m.). At *Camp CLXXIV* a red P is missing, the eastern threshold of *Kore-la* is 4,637 m. high (not 4,620 m.).

Pl. 11: At *Camps CLXXXVI, CXCI, CXCII, CXCVIII* and *CCVI* and at *Rubi-la* the red P, indicating a panorama, is missing. At *Camp CXCVI*, on

the other hand, no panorama was sketched, although a red P is entered there. West of *Camp CXCVIII* there is a P, though the corresponding panorama is missing.

Pl. 12: The height at *Camp CCXI* is 4,635 (not 4,654 m. which belongs to *Camp CCCCLI* higher up the *Samo-tsangpo*). *Camp CCXII* has the same height as *Manasarovar*, 4,602 m. (not 4,598 m.). At *Camps CCXXVI* and *CCXXVIII* the red P is missing. All the places from which panoramas were drawn will very clearly appear from the hypsometric map in 1:200,000. Round *Kailas* we find the names *Chamo-lung-chen* (not *chu*), *Dunglung* (not *Dunglang*) and *Top-chen* (not *chu*). Two kilometers N. W. of *Camp CCXXXIV* the name *Tseti-lachen-la*, 5,466 m., is missing. The panorama drawn on *Dam-karchen-la* has been lost. Some places have not got their absolute altitudes, which, however, all will be found on the map in 1:200,000 by Colonel Byström.

Pl. 13: The height 4,979 m. S. E. of *Camp CCXLV* is wrong, and has, as I have said before, to be altered to 4,782 m. At the same camp a red P has been left out. The name *Indus* should be placed along the western branch coming from the south and passing *Camp CCXLV*. S. E. of *Camp CCLIII* a part of the valley is called *Namru* (not *Namra*).

Pl. 14: *Loung* is preferable to *Laung* at *Camp CCLV*. N. W. of *Camp CCLIX* are the names *Tarae-kongma*, *Tara-yogma*, *Pu-tarhip* and *Tama-chera* (not *Tara-e*-, *-jogma*, *-Farhip* and *Tarma*-). At *Camp CCLXII* is *Tsok-gerash* (not *-gerach*). S. E. of *Camp CCLXV* is *Lungnak* (not *Languak*). Near *Chushul* is a region called *Morghu-naga* (not *Merghu*-). At *Camp CCLXVIII* is a valley *Belmik* (not *Belmia*).

Pl. 15: *Belmik* (not *Belmia*), *Chilam* (not *Chilan*), *Skamlung* (not *Shamlung*), *Camp CCLXXXIII* (not *CCXXXIII*). At *Camp CCLXXXVIII* a red P is missing.

Pl. 16: *Camp CCLXXXIX* is at an altitude of 5,383 m. (not 5,883 m.) The lake south of *Camp CCCIX* should be placed a few kilometers farther north.

Pl. 17: At *Camp CCCXIII* a red P is missing. *Shemen-tso* is at an altitude of 4,960 m. (not 4,968 m. as on the map, nor 4,950 m. as in the Meteorol. Journal). The altitude of 4,896 m. for *Camp CCCXIII* should better have been left out as it is not in accordance with the height of the lake.

Pl. 19: The panorama corresponding to the red P, N. E. of *Camp CCCLXXIV*, is missing.

Pl. 20: The name of the valley leading up to *Samye-la* is *Bupyang-ring* (not *Bubyang*-). The name *Chaktak-tsangpo* south of *Lapchung-tso* should be given to the river turning west and piercing the hills. At *Camps CCCLXXXVII* and *CCCC* panoramas were drawn, though the red P has been left out at both places.

Pl. 22: The name of *Camp CCCCXVIII* is *Saglam-lungpa* (not *-hlungpa*).

Pl. 23: The altitude of *Camp CCCCXVIII* is 5,202 m. (not 5,022). At *Camp CCCCXXXVI*, *Tayep-parva*, and at *Camp CCCCXXXVII*, *Kungme-dumly*, the red triangle indicating a camp has been omitted. At *Camp CCCCXLI* a red P is missing.



The altitude of *Poru-tso* is 5,094 m. (not 5,151).

Pl. 24: The panorama corresponding to the red P of *Camp CCCCXIX* has been lost.

Several other more or less important improvements would no doubt be necessary before the 26 sheets of the map could be said to be fairly correct, both regarding the morphological details of the country and the spelling of the names.

### C. THE PANORAMAS.

Tab. 10, Pan. 64: *Camp 54* and *Camp 55* is a misprint for 53 and 54. Tab. 12, Pan. 78<sup>A</sup> and 78<sup>B</sup> *Kinek* stands for *Rinek*. Tab. 15, Pan. 93<sup>A</sup> and B Dec. 4 stands for Dec. 5. Tab. 17, Pan. 98. From a point 4 km. east, stands for: From a point 4 km. west. Tab. 20, Pan. 113<sup>A</sup> N. 68° E. stands for N. 68° W. Tab. 25, Pan. 140. From Pass stands for From a point below the Pass. Tab. 25, Pan. 141<sup>A</sup> and B Febr. 3 stands for Febr. 7. Tab. 27, Pan. 149 S. E. stands for S. Tab. 31, Pan. 174 Apr. 26 stands for Apr. 28. Tab. 33, Pan. 181 Apr. 25 stands for Apr. 26. The same, 183<sup>A</sup> N. 9° E. stands for N. 5° E. By a mistake the *Targo-gangri* is drawn twice on this panorama. The panorama begins from a point 1 cm. to the left of S. 51° W. Tab. 36, Pan. 198<sup>B</sup>, S. 19° E., S. 40° E. and S. 55° E. stand for S. 19° W., S. 40° W. as S. 55° W. Tab. 37, Pan. 205 *Dokchu* stands for *Tsangpo*. Tab. 38, Pan. 208 N. 17° E. stands for S. 17° E. Tab. 40, Pan. 221<sup>A</sup> *Chashung* stands for *Chaslung*, and Pan. 223<sup>A</sup> and B *Rang* stands for *Rong*. Tab. 42 232<sup>A</sup> stands for 233<sup>A</sup>. Tab. 45, Pan. 248<sup>A</sup> *Kakjy* stands for *Kakju* and 249<sup>A</sup> *Jüri* for *Yüri*. Tab. 47, Pan. 256 5,019 7 km. stands for 5,015 8.8 km., and Pan. 258<sup>A</sup> *Nithi* for *Niti*. Tab. 48, Pan. 263 *Angsc* stands for *Angsi*. Tab. 51, Pan. 279<sup>B</sup> *Pachen* stands for *Pachung*. The name *Pachen* should be moved 4 cm. to the right. Tab. 52, Pan. 282<sup>B</sup>; here *Pachen* and *Pachung* have to change place. The same is the case with Pan. 285. Tab. 53, Pan. 289 shows the *Gurla-mandata* to the south and S. S. W. Tab. 54, Pan. 297, N. 75° W. stands for N. 75° E. Tab. 56, Pan. 305, *Camp 215* is a misprint for 225. Tab. 77, Pan. 425<sup>A</sup> is taken for *Camp 342*. Tab. 79, Pan. 433<sup>C</sup> has *Kung-tsakmar* instead of *Kung-tsakma*. Tab. 87, Pan. 461<sup>A</sup> and B *Bubyang* stands for *Bupyung*. Tab. 90, Pan. 485<sup>A</sup> *Dccha* stands for *Dicha*. Tab. 91, Pan. 488<sup>A</sup> *Gjandar* stands for *Gyandar*. Tab. 100, Pan. 529 *Apuk* stands for *Abuk*.

### D. THE METEOROLOGICAL JOURNAL.<sup>1</sup>

Page 42	line 1	from the bottom	<i>Shuou</i>	stands for	<i>Shuru</i>
» 54	» 11	» »	top 4,655	» »	4,615
» 98	» 1	» »	<i>Chühyün</i>	» »	<i>Chükyün</i>

<sup>1</sup> The altitude of *Teri-nam-tso* was on Pl. 21 of the map in 1:300,000 given to be 4,679 m.; 4,684 may be nearer the correct value. The altitude of *Camps CCCCX*, *CCCCXI* and *CCCCXII* in the Meteorol. Journ. p. 108 should be corrected in accordance with the height of the lake.

Page	110	line	6	from the top	<i>Kelyang</i>	stands for	<i>Kebyang</i>
»	110	»	2	»	»	bottom	5,151 » » 5,094
»	120	»	5	»	»	»	4,169 » » 4,069
»	122	»	3	»	»	top	<i>Totlung</i> » » <i>Totling</i>
»	122	»	2	»	»	bottom	<i>Sarper</i> » » <i>Sasser</i>

### E. THE MAP IN 1:200,000.

In 1918 Professor KARL D. P. ROSÉN published a scientific critical examination of the reliability and accuracy of my Tibetan panoramas, reproduced in a reduced scale in the Atlas of Panoramas.<sup>1</sup> He compared my sketches with the photographic panoramas made from the same points as some of them, and arrived at the conclusion that the exactitude was so great that it would be a pity not to make all possible use of the sketches. Only to a very small extent was this done by Lieutenant KJELLSTRÖM when he constructed the map, in 1:300,000.

Professor Rosén therefore advised me to have a new and chiefly hypsometrical map drawn where all the material of the map in 1:300,000 should be worked out more in detail from the morphological data contained in my panoramas, and the mountains should be sketched with approximate isohypses or »Gefühlsisohypsen» as the German term runs.

The new map which forms a separate atlas to this work, was to be drawn by Colonel H. BYSTRÖM. To keep the expenses within reasonable bounds we decided to make the map only in black, brown, blue and red. The range of sight of every panorama was to be marked in the map. To make it possible for students directly to compare this map with the map of my journey in 1899—1902 published in the atlas of my *Scientific Results*, we found it appropriate to have the new map reproduced in the same scale as the first one, or in 1:200,000. The larger scale also had the advantage of affording more space for morphological details. In cases where discrepancies existed between the absolute altitudes as given in the text and on the map in 1:300,000, all necessary corrections should be made, and the altitudes regarded as definitive.

Finally it was decided not to force my route into the net of co-ordinates, but to construct the map entirely upon the basis of my original field-maps. Also in this respect it would be quite equal to my map of 1899—1902, and with regard to accuracy both maps could be directly compared with one another.

I have said above, p. 203, that the length of my route from *Tankse* through Tibet and back to *Tankse* was, in my fieldbooks, found to be 4,270 km. in length. If the field survey had been correct, the polygon would have been closed at *Tankse*.

<sup>1</sup> Vide Ymer, 1918, p. 125 et seq.

An examination carried out by Colonel Byström proves, however, that there is a length-error of 109.5 km. or 2.56% of the route (4,270 km.), and a cross-error of 1.52%.

In his critical examination quoted above Professor Rosén has examined 21 different sections of routes from my journey in 1899—1902. He has subdivided them into two groups, the first of which, Nr. 1—10, are routes chiefly stretching from east to west and thus situated in latitudinal valleys. He says: »Here the length-error is as an average 2% of the route. Such an exactitude is regarded as good when stepping the distance on even ground (*Vide: Jordan, Handbuch der Vermessungskunde*, 1908, II, p. 85).» Professor Rosén regards the result of the first group as very good. The second group, Nr. 11—21, chiefly consists in meridional routes crossing passes and difficult ground. Here the length-error is 4—5%, which Rosén regards as quite satisfactory. In the first group the cross-error was found to be approximately 2% or the same as the length-error.

The polygon mentioned above is partly meridional, crossing passes, partly running east-west through latitudinal valleys. As could be expected, the length-error therefore will be more than 2% and less than 4—5%, and indeed it was found to be 2.56%.

The polygonal route I travelled in 1900 through North-eastern Tibet from *Temirlik* to the south, west, north and finally back eastwards to *Temirlik* was 1,656 km. in length. The endpoint fell 31 km. east of the starting point, being thus with an error of 1.81%; and 9 km. north of it, being 0.54%.

In 1900 and 1901 I accomplished another polygon, starting from *Altmiş-bulak* and going S. S. W. through the desert of *Lop*, further S. E. and E. N. E. through the mountains of *Astin-tagh* and *Akato-tagh* to *Anambaruîn-ula*, thence northward through the desert to *Kuruk-tagh* and westwards back to *Altmiş-bulak*. This polygon is 1,460 km. in length, the length-error 0.205% and the cross-error practically 0%, as I reached the very spring in the middle of the desert and in very foggy weather, without assistance of astronomical observations. In this case the ground was very favourable and comfortable. From the dates given above we find the law, so natural in itself: the error increases in the same proportion as the ground becomes worse. The most difficult routes of all are the meridional ones through Tibet during the summer when the ground is soft. The easiest and nearly level regions are to be found in those parts of the Central-asiatic deserts where there is no sand, and here the winter is the best season. Thus we find:

	Length-error.	Cross-error.
Meridional routes in Tibet during the summer . . .	4—5%	
Meridional and latitudinal routes in Tibet all directions and all seasons . . . . .	2.56%	1.52%
Latitudinal valleys in Tibet all seasons . . . . .	about 2%	about 2%

	Length-error.	Cross-error.
Plateau-land of Eastern Tibet all directions, summer and autumn . . . . .	1.81%	0.54%
N. E. Tibet and Eastern Turkestan, very comfortable ground, winter . . . . .	0.205%	0.0%

On my journey through Eastern Persia, winter and spring 1906 I had, on a distance of 1,980 km. a length-error of 0.405%, a result which would have become much finer had I not had to cross the Great desert of *Kevir* twice in rain.

One of the most difficult stretches of ground I ever had to pass was in the *Shayok* valley, and there the result proves to be miserable. I have accomplished the same route twice in this valley, both times during the cold season, when the river was partly frozen, and the road had to cross it on the ice and in the water several times, the rest of the valley being covered with gravel and stones and snow. In April 1902 I got, from the village of *Shayok* to the entrance of the *Murgho-valley* a distance of 178 km., and in December 1907 151 km. The two values obtained cannot, however, be compared with one another, as only the second route has been forced into the net of co-ordinates, whilst the first has been left as it was found from my fieldbooks.

The distance between *Tanksc* and the west-end of *Lake Punggong*, on the other hand, proved to be the same in both cases. I travelled this road the first time in December 1901, and found the distance to be 33.6 km., and the second time in August 1906 and found the same distance to be 33.7 km., which was a surprisingly good result.

A very detailed description of the method I have used for arriving at the most accurate results in field-survey which possibly can be obtained, is to be found in Vol. II of my work: *Eine Routenaufnahme durch Ostpersien*, Stockholm 1922.



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